Med
A

TRANSACTIONS

OF THE

AMERICAN

SURGICAL ASSOCIATION.

VOLUME THE SEVENTEENTH.

EDITED BY

DE FOREST WILLARD, A.M., M.D., PH.D.,
RECORDER OF THE ASSOCIATION.

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OFFICERS OF THE ASSOCIATION,

ELECTED JUNE, 1899.

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22 Newbury Street, Boston.

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1631 Walnut Street, Philadelphia.

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HERBERT L. BURRELL, M.D.
W. W. KEEN, M.D.

Place of next Meeting—WASHINGTON, MAY 1—3, 1900.

COMMITTEE OF ARRANGEMENTS.

J. FORD THOMPSON, M.D.
W. S. HALSTED, M.D.
GEO. BEN JOHNSTON, M.D.

LIST OF THE PRESIDENTS

OF THE

ASSOCIATION FROM THE TIME OF ITS INSTITUTION.

ELECTED

1880.† SAMUEL DAVID GROSS, M.D., LL.D., D.C.L. Oxon., LL.D. Cantab., LL.D. Edin.—Founder of the Association.

1883. EDWARD MOTT MOORE, M.D., LL.D.

1884.† WILLIAM THOMPSON BRIGGS, M.D.

1885.† MOSES GUNN, A.M., M.D., LL.D.

1886. HUNTER McGUIRE, M.D., LL.D.

1887.† D. HAYES AGNEW, M.D., LL.D.

1888. DAVID WILLIAMS CHEEVER, M.D., LL.D.

1889.† DAVID W. YANDELL, M.D.

1890.† CLAUDIUS HENRY MASTIN, M.D., LL.D.

1891. PHINEAS SANBORN CONNER, M.D., LL.D.

1892. NICHOLAS SENN, M.D., Ph.D., LL.D.

1893. J. EWING MEARS, A.M., M.D.

1894. FREDERIC SHEPARD DENNIS, M.D.

1895. LOUIS McLANE TIFFANY, A.M. Cantab., M.D.

1896. JOHN COLLINS WARREN, M.D., LL.D.

1897. THEODORE F. PREWITT, M.D.

1898. WILLIAM W. KEEN, A.M., M.D., LL.D.

1899. ROBERT F. WEIR, M.D.

† Deceased.

NOTICE.

THIS volume of TRANSACTIONS contains the papers read before the Association at the Meeting held May 31, and June 1 and 2, 1899.

The Association assumes no responsibility for the statements and opinions published in this volume.

FELLOWS

OF THE

AMERICAN SURGICAL ASSOCIATION.

MAY, 1899.

*Denotes Original Fellows.

ELECTED

1890. ABBE, ROBERT, M.D., 13 West Fiftieth Street, New York. Surgeon to St. Luke's Hospital.

1894. ALLEN, DUDLEY P., A.M., M.D., 278 Prospect Street, Cleveland, Ohio. Professor of Surgery, Medical Department Western Reserve University; Visiting Surgeon, Lakeside and Charity Hospitals; Consulting Surgeon to the Cleveland City Hospital.

1890. ALLIS, OSCAR HUNTINGTON, A.M., M.D., 1604 Spruce Street, Philadelphia. Surgeon to the Presbyterian Hospital.

*1880. ASHHURST, JOHN, Jr., M.D., LL.D., 2000 West De Lancey Place, Philadelphia. Professor of Surgery and of Clinical Surgery in the University of Pennsylvania; Surgeon to the Pennsylvania Hospital; Senior Surgeon to the Children's Hospital. *Vice-President*, 1896.

1882. BARTON, JAMES M., A.M., M.D., 1337 Spruce Street, Philadelphia. Surgeon to the Jefferson Medical College Hospital and to the Philadelphia Hospital.

1896. BAXTER, GEORGE A., A.M., M.D., Chattanooga, Tennessee. Professor of Surgery, Chattanooga Medical College; Surgeon to Queen & Crescent and to Southern Systems; Surgeon to Nashville & Chattanooga, to Chattanooga Union, to Lookout Mountain, and to Electric System of Railways.

ELECTED

1882. Bontecou, Reed Brockway, M.D., 82 Fourth Street, Troy, N. Y. Surgeon to the Marshall Infirmary.

1890. Bradford, Edward Hickling, A.B., M.D., 133 Newbury Street, Boston. Surgeon to the Children's and the Samaritan Hospitals; Assistant Professor of Orthopædic Surgery in the Harvard University.

*1880. Brinton, John H., M.D., 1423 Spruce Street, Philadelphia. Professor of the Practice of Surgery and of Clinical Surgery in the Jefferson Medical College; Surgeon to St. Joseph's Hospital. *Treasurer*, 1884–85.

1895. Bryant, Joseph D., M.D., 54 West Thirty-sixth Street, New York. Professor of Anatomy and of Operative and Clinical Surgery, Bellevue Hospital Medical College; Surgeon to Bellevue and St. Vincent's Hospitals; Consulting Surgeon to Gouverneur Hospital, Hospital for Ruptured and Crippled, St. Joseph's and Hackensack Hospitals, Asylum for Insane, New York, etc.

1882. Bull, William Tillinghast, A.B., M.D., 35 West Thirty-fifth Street, New York. Adjunct Professor of the Practice of Surgery and of Clinical Surgery in the College of Physicians and Surgeons, New York; Surgeon to the New York and St. Luke's Hospitals; Consulting Surgeon to the Hospital for Ruptured and Crippled, and to the New York Cancer Hospital.

1893. Burrell, Herbert Leslie, M.D. (Harvard), *Secretary*, 22 Newbury Street, Boston, Mass. Assistant Professor of Surgery in Harvard University; Visiting Surgeon, Boston City Hospital; Visiting Surgeon, The Children's Hospital; Consulting Surgeon, Carney Hospital and the Quincy Hospital.

1889. Cabot, Arthur Tracy, A.M., M.D., 3 Marlborough Street, Boston, Mass. Surgeon to the Massachusetts General Hospital.

1885. Carmalt, William H., A.M., M.D., 87 Elm Street, New Haven, Conn. Professor of Surgery in Yale University; Surgeon to the New Haven Hospital. *Vice-President*, 1895.

1896. Carson, Norman Bruce, M.D., 209 North Jefferson Avenue, St. Louis, Mo. Professor of Clinical Surgery in St. Louis

ELECTED

Medical College; Surgeon to the St. Louis, Mullanphy, and Martha Parsons' Hospitals. St. Vincent Insane Asylum, etc.

1882. CHEEVER, DAVID WILLIAMS, M.D., LL.D., 557 Boylston Street, Boston, Mass. Professor of Surgery (Emeritus) in Harvard University; Surgeon to the Boston City Hospital. *President*, 1888.

1896. COLE, CHARLES KNOX, A.M., M.D., Helena, Montana. Surgeon to St. John's, St. Peter's, and County Hospitals.

1898. COLEY, WILLIAM B., M.D., 5 Park Avenue, New York. Attending Surgeon to the New York Cancer Hospital; Assistant Surgeon to the Hospital for Ruptured and Crippled.

*1880. CONNER, PHINEAS SANBORN, M.D., LL.D., 159 West Ninth Street, Cincinnati, Ohio. Professor of Surgery in the Medical College of Ohio; Professor of Surgery, Dartmouth Medical College; Surgeon to the Cincinnati and the Good Samaritan Hospitals. *President*, 1891; *Member of Council*, 1883 and 1895–99; *Treasurer*, 1885–91.

1896. CURTIS, BENJAMIN FARQUHAR, A.B., M.D., 7 East Forty-first Street, New York. Adjunct Professor of the Principles of Surgery and Professor of Clinical Surgery, University and Bellevue Hospital Medical College of New York; Attending Surgeon to St. Luke's and Bellevue Hospitals, and the General Memorial Hospital for Treatment of Cancer and Allied Diseases; Consulting Surgeon to New York Orthopædic Hospital and Dispensary.

1896. CUSHING, HAYWARD WARREN, A.B., M.D., 70 Commonwealth Avenue, Boston, Mass. Junior Visiting Surgeon, Boston City Hospital; Assistant Surgeon, Children's Hospital, Boston.

1897. DA COSTA, JOHN CHALMERS, M.D., 1629 Locust Street, Philadelphia, Pa. Clinical Professor of Surgery, Jefferson Medical College; Surgeon to the Philadelphia and the Phœnixville Hospitals.

1883. DANDRIDGE, NATHANIEL PENDLETON, M.D., 422 Broadway, Cincinnati, Ohio. Professor of Practice of Surgery and of

ELECTED

Clinical Surgery in the Miami Medical College, Cincinnati. *Treasurer*, 1894–96.

1892. DEAVER, JOHN B., M.D., 1634 Walnut Street, Philadelphia. Surgeon to the Philadelphia and German Hospitals, Philadelphia.

1882. DENNIS, FREDERIC SHEPARD, M D., F.R.C.S. Eng. (Hon.), 542 Madison Avenue, New York. Professor of Clinical Surgery, Cornell University, New York City; Visiting Surgeon to the Bellevue and St. Vincent's Hospitals; Consulting Surgeon to St. Joseph's Hospital, Yonkers and Montefiore Home, New York City. *President*, 1894; *Vice-President*, 1887; *Member of Council*, 1889.

1899. DUNN, JAMES H., M.D., 337 Oak Grove Street, Minneapolis, Minn. Professor of Practice of Surgery, Medical Department, University of Minnesota.

1893 ELLIOT, JOHN WHEELOCK, A.M., M.D. (Harvard), 124 Beacon Street, Boston. Surgeon to Massachusetts General Hospital.

1896. ESTES, WILLIAM LAWRENCE, A.M., M.D., South Bethlehem, Penna. Director and Surgeon-in-Chief of St. Luke's Hospital; Lecturer on Hygiene at Lehigh University.

1898. EVE, DUNCAN, A.M., M.D., 700 Church Street, Nashville, Tenn. Surgeon to the Nashville City Hospital; Chief Surgeon, Nashville, Chattanooga & St. Louis R.R.; Professor of Surgery and Clinical Surgery, Medical Department Vanderbilt University, Nashville.

1883. FENGER, CHRISTIAN, M.D., 269 La Salle Avenue, Chicago. Professor of Clinical Surgery, Rush Medical College; Professor of Clinical Surgery in the Northwestern University Medical School and the Chicago Polyclinic; Surgeon to Emergency, German, Mercy, and Norwegian Hospitals. *Vice President*, 1895.

1899. FINNEY, JOHN T., M.D., 1300 Eutaw Place, Baltimore, Md. Associate Professor of Surgery, Johns Hopkins University.

1882. FORBES, WILLIAM SMITH, M.D., 901 Pine Street, Philadelphia. Professor of Anatomy in the Jefferson Medical College of

ELECTED

Philadelphia; Surgeon to the Protestant Episcopal Hospital.

1891. FOWLER, GEORGE RYERSON, M.D., *Treasurer*, 301 De Kalb Avenue, Brooklyn, New York. Professor of Surgery, New York Polyclinic; Examiner in Surgery, Medical Examining Board of Regents, University State of New York; Surgeon to the Methodist Episcopal Hospital and the Brooklyn Hospital; Consulting Surgeon to the Norwegian, the Relief (E. D.), and the Bushwick Hospitals; Division Surgeon of Seventh Army Corps.

1898. FREEMAN, LEONARD, B.S., M.D., California Building, Denver, Col. Professor of Surgery, Gross Medical College; Surgeon to the Arapahoe County Hospital and to St. Anthony's Hospital.

1891. GASTON, JAMES MCFADDEN, A.B., M.D., 421 Capitol Avenue, Atlanta, Georgia. Professor of Surgery in Southern Medical College. *Vice-President*, 1897.

1882. GAY, GEORGE WASHINGTON, A.M., M.D., 665 Boylston Street, Boston, Mass. Senior Surgeon to the Boston City Hospital; Clinical Instructor in Surgery in Harvard University. *Member of Council*, 1882.

1892. GERRISH, FREDERIC HENRY, A.M., M.D., 675 Congress Street, Portland, Maine. Consulting Surgeon, Maine General Hospital; Professor of Anatomy in Medical Department of Bowdoin College.

1890. GERSTER, ARPAD G., M.D., Chir.D., 34 East Seventy-fifth Street, New York. Professor of Surgery in the New York Polyclinic; Surgeon to the German and Mount Sinai Hospitals.

1892. HALSTED, WILLIAM STEWART, B.A., M.D., 1201 Eutaw Place, Baltimore, Maryland. Surgeon to Johns Hopkins Hospital.

1898. HARRINGTON, FRANCIS B., M.D., 201 Beacon Street, Boston, Mass. (A.B., Tuft's College; M.D., Harvard College). Surgeon to Massachusetts General Hospital.

1895. HARTE, RICHARD H., M.D., 1503 Spruce Street, Philadelphia. Demonstrator of Osteology in the University of Pennsyl-

ELECTED

vania; Surgeon to the Pennsylvania and Episcopal Hospitals; Assistant Surgeon to the University Hospital; Consulting Surgeon, St. Mary's and St. Timothy's Hospitals.

1898. HEARN, W. JOSEPH, M.D., 1120 Walnut Street, Philadelphia. Clinical Professor of Surgery, Jefferson Medical College; Visiting Surgeon to the Philadelphia Hospital; Consulting Surgeon to the Phœnixville General Hospital.

1889. HOMANS, JOHN, A.B., M.D., 164 Beacon Street, Boston. Surgeon to the Massachusetts General Hospital.

1899. HORWITZ, ORVILLE, M.D., 1721 Walnut Street, Philadelphia. Clinical Professor of Genito-Urinary Diseases, Jefferson Medical College; Surgeon to Philadelphia Hospital; Consulting Surgeon to State Hospital for Insane and Hayes Mechanics' Home.

1896. JOHNSTON, GEORGE BEN, M.D., 207 East Grace Street, Richmond, Va. Professor of the Practice of Surgery and of Clinical Surgery in the Medical College of Virginia; Surgeon to the Old Dominion Hospital, and Consulting Surgeon to the Richmond City Free Dispensary.

1899. KAMMERER, FREDERICK, M.D., 667 Madison Avenue, New York City. Professor of Clinical Surgery, Cornell Medical College; Surgeon to the German and St. Francis' Hospitals, New York.

1880. KEEN, WILLIAM WILLIAMS, A.M., M.D., LL.D., 1729 Chestnut Street, Philadelphia. Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Surgeon to the Jefferson Medical College Hospital and to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to the Woman's and St. Agnes' Hospitals; Membre Correspondant Etrangé de la Societé de Chirurgie de Paris; Membre Honoraire de la Société Belge de Chirurgie. *President*, 1898; *Vice-President*, 1892; *Member of Council*, 1899.

1890. LANE, LEVI COOPER, A.M., M.D., M.R.C.S. Eng., LL.D., San Francisco, Cal. Professor of Surgery in the Cooper Medical College, San Francisco. *Vice-President*, 1891.

1889. LANGE, FREDERICK E., M.D., 691 Lexington Avenue, New York.

ELECTED

1896. McCosh, Andrew J., B.A., M.D., 16 East Fifty-fourth Street, New York. Surgeon to the Presbyterian Hospital; Clinical Lecturer on Surgery, College of Physicians and Surgeons.

1882. McGraw, Theodore A., M.D., 107 West Fort Street, Detroit, Michigan. Professor of Surgery in the Detroit Medical College; Surgeon to St. Mary's and the Harper Hospitals. *Vice-President*, 1896.

*1880. McGuire, Hunter, M.D., LL.D., 513 East Grace Street, Richmond, Va. President of the University College of Medicine and Professor of Clinical Surgery; Surgeon to St. Luke's and Virginia Hospitals. *President*, 1886; *Member of Council*, 1880–85.

*1880. Marks, Solon, M.D., 136 Wisconsin Street, Milwaukee, Wis. Surgeon to St. Mary's Hospital. *Vice-President*, 1898.

1899. Markoe, Francis H., M.D., 15 E. Forty-ninth street, New York. Clinical Lecturer on Surgery, Medical Department Columbia University, New York City; Attending Surgeon, St. Luke's and Bellevue Hospitals, New York; Consulting Surgeon, Orthopædic Hospital, New York City.

1898. Martin, Edward, M.D., 415 S. Fifteenth Street, Philadelphia. Clinical Professor of Genito-Urinary Diseases, University of Pennsylvania; Clinical Professor of Surgery, Woman's Medical College, Philadelphia; Physician to Philadelphia, St. Agnes', and Howard Hospitals; Brigade Surgeon, Third Regiment, N. G. P.

1887. Mastin, William McDowell, M.D., Northwest corner of Joachim and Conti Streets, Mobile, Ala.; Surgeon to the Mobile City Hospital.

1895. Matas, Rudolph, M.D., 2255 St. Charles Street, New Orleans, La. Professor of Surgery, Medical Department Tulane University; Professor of Clinical Surgery, New Orleans Polyclinic; Surgeon to Charity Hospital; Consulting Surgeon to the Eye, Ear, Nose, and Throat Hospital.

1899. Mayo, William J., M.D. 427 West College Street, Rochester, Minn. Surgeon to St. Mary's Hospital.

*1880. Mears, J. Ewing, A.M., M.D., 1429 Walnut Street, Philadelphia. Professor of Anatomy and of Clinical Surgery in the Pennsylvania College of Dental Surgery. *President*, 1893; *Recorder*, 1881–93.

ELECTED

1898. MILLER, TRUMAN W., M.D., 1071 N. Clark Street, Chicago. President and Professor of General and Genito-Urinary Surgery, Chicago Polyclinic; Vice-President, Military Surgeons' Association, I. N. G.; Surgeon to Maurice Porter Hospital; Consulting Surgeon to St. Joseph's, The Alexian, and German Hospitals.

1893. MIXTER, SAMUEL JASON, S B. (Massachusetts Institute of Technology), M.D. (Harvard), 180 Marlborough Street, Boston. Surgeon to Massachusetts General Hospital and to Carney Hospital; Consulting Surgeon to the Massachusetts Charity Eye and Ear Infirmary; Instructor in Surgery in the Harvard University.

1896. MONKS, GEORGE HOWARD, A.B. (Harvard), M.D. (Harvard), M.R C.S. (Eng.), 405 Boylston Street, Boston. Surgeon to Carney Hospital; Assistant Visiting Surgeon, Boston City Hospital; Instructor in Clinical and Assistant in Operative Surgery, Harvard Medical School; Instructor in Surgical Pathology, Harvard Dental School.

1895. MOORE, JAMES E., M.D., 802 Dayton Building, Minneapolis, Minn. Professor of Clinical Surgery, University of Minnesota; Surgeon to St. Barnabas and Northwestern Hospitals; Consulting Surgeon to St. Mary's and City Hospitals.

*1880. MORTON, THOMAS GEORGE, M.D., 1421 Chestnut Street, Philadelphia. Surgeon to the Pennsylvania, the Orthopædic, and the Jewish Hospitals.

1898. MORTON, THOMAS S. K., 1506 Locust Street, Philadelphia. Professor of Surgery, Woman's Medical College of Pennsylvania; Professor of Surgery, Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the Out-Patient Department of the Pennsylvania Hospital; Assistant Surgeon to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases.

1886. MUDD, HENRY H., M.D., 2604 Locust Street, St. Louis, Mo. Professor of Surgical Anatomy and Clinical Surgery in St. Louis Medical College; Surgeon to St. Luke's Hospital; Dean of Washington University Medical Department.

1898. MURRAY, FRANCIS W., M.D., 32 W. Thirty-ninth Street, New York City. Professor of Clinical Surgery in Cornell Uni-

ELECTED

versity Medical College; Surgeon to the New York and St. Luke's Hospitals.

1882. NANCREDE, CHARLES BEYLARD, A.M., M.D., LL D. (Jefferson). *Vice-President*, Southwest corner of Thayer Street and South University Avenue, Ann Arbor, Mich. Professor of Surgery in the University of Michigan. *Vice-President*, 1889.

1882. OWENS, JOHN E., M.D., 1806 Michigan Avenue, Chicago. Professor of Principles and Practice of Surgery and Clinical Surgery in the Chicago Medical College; Surgeon to St. Luke's Hospital.

*1880. PACKARD, JOHN H., M.D., 225 South Sixteenth Street, Philadelphia. Surgeon to St. Joseph's Hospital. *Treasurer*, 1880–83.

1899. PARHAM, F. W., M.D., 2911 Prytania Street, New Orleans, La. Professor of Clinical and Operative Surgery in the New Orleans Polyclinic; Visiting Surgeon, Charity Hospital, New Orleans.

1885. PARK, ROSWELL, A.M., M.D., 510 Delaware Avenue, Buffalo, N. Y. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital. *Vice-President*, 1893; *Member of Council*, 1893–94.

1896. PARKHILL, CLAYTON, M.D., 245–46 Equitable Building, Denver, Col. Dean of the Colorado School of Medicine. Medical Department of the University of Colorado, and Professor of the Principles and Practice of Surgery and Clinical Surgery in the same; Professor of Surgery in Gross Medical College, Denver; Surgeon to St. Luke's and the Arapahoe County Hospitals, Denver; Surgeon-in-Chief to the Citizens' Hospital, Aspen, Col.; Consulting Surgeon to the State Hospital for the Insane, Pueblo, Col.; Surgeon-General of the National Guard of Colorado; Late Major and Chief-Surgeon of Volunteers, U.S.A.

1893. PARMENTER, JOHN, M.D., 519 Franklin Street, Buffalo, N. Y. Professor of Anatomy and Clinical Surgery in the Medical Department of the University of Buffalo; Surgeon to the Erie County, Fitch, and Children's Hospitals; Assistant Surgeon to the Buffalo General Hospital.

ELECTED

1889. PILCHER, LEWIS S., A.B., M.D., 145 Gates Avenue, Brooklyn, N. Y. Professor of Clinical Surgery in the Post-Graduate Medical School, New York; Surgeon to the Methodist Episcopal Hospital. *Vice-President*, 1893.

1887. PORTER, CHARLES BURNHAM, A.M., M.D. (Harv.), 5 Arlington Street, Boston, Mass. Professor of Clinical Surgery in Harvard University; Surgeon to the Massachusetts General Hospital. *Vice-President*, 1892.

1882. PORTER, WILLIAM GIBBS, M.D., 1118 Spruce Street, Philadelphia. Surgeon to the Presbyterian Hospital.

1896. POWERS, CHARLES A., M.D., Fourteenth and Stout Streets, Denver, Col. Professor of Surgery in the University of Denver, and Surgeon to the Arapahoe County Hospital and to St. Luke's Hospital.

1882. PREWITT, THEODORE F., M.D., 3101 Pine Street, St. Louis, Mo. Professor of the Principles of Surgery in the Medical Department of Washington University; Surgeon to St. John's Hospital. *President*, 1897; *Vice President*, 1886; *Member of Council*, 1894–96.

1886. RANSOHOFF, JOSEPH, M.D., F.R.C.S. (Eng.), 706 Walnut Street, Cincinnati, Ohio. Professor of Anatomy in the Medical College of Ohio; Surgeon to the Cincinnati and the Good Samaritan Hospitals.

1887. RICHARDSON, MAURICE HOWE, A.B., M.D., 224 Beacon Street, Boston, Mass. Surgeon to the Massachusetts General Hospital; Assistant Professor of Clinical Surgery in Harvard University. *Vice-President*, 1897; *Secretary*, 1894–96.

1882. ROBERTS, JOHN B., A.M., M.D., 1627 Walnut Street, Philadelphia. Professor of Anatomy and Surgery in the Philadelphia Polyclinic; Surgeon to the Methodist and the Jewish Hospitals. *Vice-President*, 1888 and 1894; *Treasurer*, 1892–93.

1898. RODMAN, WILLIAM L., A.M., M.D., 1626 Spruce Street, Philadelphia. Professor of the Principles of Surgery and Clinical Surgery in the Medico-Chirurgical College, Philadelphia.

1882. RUSHMORE, JOHN DIKEMAN, M.D., 129 Montague Street, Brooklyn, N. Y. Professor of Surgery in the Long Island

ELECTED.

College Hospital; Surgeon to the Brooklyn, the St. Peter's, and the Eye and Ear Hospitals.

*1880. SAYRE, LEWIS ALBERT, M.D., 285 Fifth Avenue, New York. Emeritus Professor of Orthopædic Surgery in the University and Bellevue Hospital Medical College; Consulting Surgeon to the Bellevue, the Charity, and the St. Elizabeth's Hospitals, and to the Home for Incurables.

1882. SENN, NICHOLAS, M.D., Ph.D., LL.D. (Jefferson), 532 Dearborn Avenue, Chicago, Ill. Professor of the Principles of Surgery and Clinical Surgery in Rush Medical College; Surgeon to the Presbyterian Hospital; Surgeon-in-Chief to St. Joseph's Hospital. *President*, 1892; *Member of Council*, 1897.

1895. SOUCHON, EDMOND, M.D., *Vice-President*, 135 Baronne Street, New Orleans, La. Professor of Anatomy and of Clinical Surgery, Tulane University; Surgeon to Charity Hospital; Consulting Surgeon to the Eye, Ear, Nose, and Throat Hospital.

1885. THOMPSON, J. FORD, M.D., 1401 H Street, N. W., Washington, D. C. Professor of Surgery in the National Medical College; Surgeon to the Garfield Memorial and the Children's Hospitals.

1882. THOMSON, WILLIAM, M.D., 1426 Walnut Street, Philadelphia. Emeritus Professor of Ophthalmology in the Jefferson Medical College.

1882. TIFFANY, LOUIS MCLANE, A.M. (Cantab.), M.D.; 831 Park Avenue, Baltimore, Md. Professor of Surgery in the University of Maryland; Surgeon to the University Hospital. *President*, 1895; *Member of Council*, 1885–89, and 1896–97.

1882. VANDER VEER, ALBERT, A.M., M.D., Ph.D., 28 Eagle Street, Albany, N. Y. Dean of the Albany Medical College; Professor of Didactic Abdominal Surgery and of Clinical Surgery in the Albany Medical College; Consulting Surgeon to St. Peter's Hospital; Attending Surgeon to the Albany Hospital. *Vice-President*, 1898.

1891. WALKER, EDWARD W., M.D., 96 West Eighth Street, Cincinnati, Ohio. Professor of Surgery, Miami Medical College.

ELECTED.

1882. WARREN, JOHN COLLINS, M.D., LL.D. (Jefferson), 58 Beacon Street, Boston, Mass. Professor of Surgery in Harvard University; Surgeon to the Massachusetts General Hospital. *President*, 1896; *Vice-President*, 1890; *Member of Council*, 1897.

1896. WATSON, FRANCIS SEDGWICK, A.B., M.D., 92 Marlborough Street, Boston. Surgeon to the Boston City Hospital; Instructor in Genito-Urinary Surgery, Harvard Medical School.

1889. WEEKS, STEPHEN H., M.D., 662 Congress Street, Portland, Maine. Professor of Surgery in the Medical School of Maine; Surgeon to Maine General Hospital. *Member of Council*, 1893.

1889. WEIR, ROBERT F., M.D., *President*, 37 West Thirty-third Street, New York. Professor of Surgery in the College of Physicians and Surgeons; Surgeon to the New York Hospital; Consulting Surgeon to the Roosevelt and St. Luke's Hospitals. *Member of Council*, 1893–96.

*1880. WEIST, JACOB ROWLAND, A.M., M.D., 118 North Eighth Street, Richmond, Ind. Surgeon to St. Stephen's Hospital. *Vice-President*, 1894; *Secretary*, 1880–94.

1892. WHARTON, HENRY R., A.M., M.D., 1725 Spruce Street, Philadelphia. Demonstrator of Surgery, University of Pennsylvania; Surgeon to the Presbyterian, the Children's, and the Methodist Hospitals; Assistant Surgeon to the University Hospital.

1882. WHITE, J. WILLIAM, M.D., Ph.D., 1810 South Rittenhouse Square, Philadelphia. Professor of Clinical Surgery in the University of Pennsylvania.

1891. WIGHT, JARVIS SHERMAN, A.M., M.D., LL.D, 30 Schermerhorn Street, Brooklyn, N. Y. Professor of Operative and Clinical Surgery, Long Island College Hospital; Surgeon to Long Island College Hospital; Consulting Surgeon to St. Mary's Hospital.

1882. WILLARD, DE FOREST, A.M., M.D. (Univ. of Pa.), Ph.D., *Recorder*, 1601 Walnut Street, Philadelphia. Surgeon to the Presbyterian Hospital; Clinical Professor of Orthopædic Surgery in the University of Pennsylvania; Consulting Surgeon to the Hospital for the Chronic Insane of Pennsylvania, and to the New Jersey Training School.

HONORARY FELLOWS.

ELECTED

1885. ANNANDALE, THOMAS, M.R.C.S., Eng., M.D., Edin., 34 Charlotte Square, Edinburgh, Scotland. Regius Professor of Clinical Surgery in the University of Edinburgh.

1894. VON BERGMANN, PROF. DR. ERNST, Geh. Med. Rath., Klin. Institut für Chirurgie, Berlin, Germany.

1891. BRYANT, THOMAS, ESQ., F.R.C.S., Eng., 65 Grosvenor Street, Grosvenor Square, W., London.

1891. CHIENE, JOHN, F.R.C.S., Edin., M.D., Edin., 26 Charlotte Square, Edinburgh, Scotland. Professor of Surgery in the University of Edinburgh.

1885. CZERNY, PROF. DR. VINCENT, 25 Sophien Strasse, Heidelberg, Germany. Professor of Surgery in the University of Heidelberg.

1885. VON ESMARCH, PROF. DR. FRIEDRICH, 2 Hospitalberg, Kiel, Schleswig-Holstein, Germany. Professor of Surgery in the University of Kiel.

1893. GUSSENBAUER, PROF. DR. CARL, ix. Ferstelgasse 5, Vienna. Imperial and Royal Professor of Surgery and Chief of the Second Surgical Clinic and of the Surgical Institute.

1891. HARRISON, REGINALD, ESQ., F.R.C.S., Eng., 6 Lower Berkeley Street, Portman Square, W., London.

1890. HORSLEY, VICTOR ALEXANDER HADEN, F.R.C.S., Eng., 25 Cavendish Square, W., London.

1883. HORWITZ, P. J., M.D., 1919 Walnut Street, Medical Director U. S. Navy (Retired), Philadelphia.

1894. KOCHER, PROF. DR. THEODOR, Professor of Surgery, University of Berne, Villette 25, Berne, Switzerland.

1885. LISTER, LORD JOSEPH, F.R.C.S., Eng., D.C.L., LL.D., 12 Park Crescent, London, N. W. Professor of Clinical Surgery in King's College.

ELECTED

1886. MacCormac, Sir William, Bart., F.R.C.S., England and Ireland, 13 Harley Street, London, W. Surgeon to St. Thomas' Hospital.

1894. Macewen, William, M.D., Mast. Surg., 3 Woodside Crescent, Glasgow, Scotland.

*1880. Moore, Edward Mott, M D., LL.D., 74 South Fitzhugh Street, Rochester, N. Y. Surgeon to St. Mary's Hospital. *President*, 1884.

1887. Ollier, Prof. Dr. Leopold, 3 Quai de la Charité, Lyons, France.

1885. Paget, Sir James, Bart., D.C.L., LL.D., F.R.C.S., Eng., 5 Park Square, N. W., Regent's Park, London.

1894. Schede, Prof. Dr., Geh. Med. Rath., Director of Surgery, University Clinic, Bonn, Germany.

1882. Smith, Stephen, A.M., M.D., LL.D., 574 Madison Avenue, New York. Professor of Clinical Surgery in the University Medical College of New York; Surgeon to the Bellevue and the St. Vincent's Hospitals. *Vice-President*, 1890.

1896. Terrier, Dr. Felix, 3 Rue de Copenhague, Paris. Professor of Operative Surgery in the Faculty of Medicine of Paris; Surgery to the Hôpital Bichat.

* Original Fellows.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

ARTICLE I.—NAME.

This society shall be called THE AMERICAN SURGICAL ASSOCIATION.

ARTICLE II.—OBJECT.

The object of this Association shall be the cultivation and improvement of the science and art of surgery, the elevation of the medical profession, and such other matters as may come legitimately within its sphere.

ARTICLE III.—MEMBERSHIP.

SECTION 1. This Association shall consist of active and honorary Fellows.

SECT. 2. The active membership shall be limited to one hundred and twenty-five (125) Fellows. The honorary membership shall be limited to twenty-five (25) Fellows, of whom not more than fifteen (15) shall be foreign and the remainder American.

SECT. 3. Propositions for Fellowship shall be made by Fellows, on blanks furnished by the Secretary of the Association. The proposal of a candidate for Fellowship shall be signed by three Fellows, who shall vouch for his character and standing. No one shall be eligible for Fellowship unless he is thirty years of age and a graduate of five years' standing from a recognized medical college, and has established a reputation as a practitioner, author, teacher or original investigator, and has been recommended by the Council. All propositions for Fellowship shall lie over for one year from the time of their reception by the Association.

SECT. 4. The proposers of a candidate shall, within thirty days of

the reception of the proposal for Fellowship, send to the Secretary a confidential letter, an abstract of which, without the name of the writer, shall be presented by the Secretary to the Council, and the original letter returned to the writer.

SECT. 5. Election to Fellowship shall be by ballot, on the third day of each annual meeting, and if three-fourths of the ballots are favorable the candidate shall be declared elected.

SECT. 6. Fellows after election must qualify within six (6) months by the payment of the initiation fee and annual dues.

SECT. 7. Any candidate for Fellowship that is rejected by the Association cannot again be proposed for membership except after the lapse of two years.

SECT. 8. Honorary Fellows shall be proposed and elected in the same manner as active Fellows. They shall not be required to pay any fees or dues, nor shall they be privileged to vote or hold office.

SECT. 9. The resignation of a Fellow may be accepted by a two-thirds vote of the members present, provided he is not in arrears.

SECT. 10. Any violation of the Constitution or By-Laws, or conduct unbecoming a gentleman, may be punished by a reprimand, suspension, or expulsion.

ARTICLE IV.—OFFICERS.

SECTION 1. The officers of the Association shall consist of a President, two Vice-Presidents, a Secretary, a Treasurer, and a Recorder. There shall also be a Council and a Committee on Annual Meeting.

SECT. 2. Nominations. All officers, including the member of the Council and the two (2) members of the Committee on Annual Meeting, and on every third year a Delegate and Alternate to the Congress of American Physicians and Surgeons shall be nominated by a committee of five Fellows, which committee shall be appointed by the President on the first day of the annual meeting.

SECT. 3. Elections. The election of officers shall take place at the executive session on the third day of the annual meeting. A majority of the votes cast shall constitute an election.

SECT. 4. Vacancies. Any vacancy occurring during the year among the officers of the Association shall be filled by the Council.

BY-LAWS.

Section I.—Meetings.

The annual meeting of the Association shall be held at such time and place as may be designated by a vote of the Association. The selected place of meeting may be changed under extraordinary exigencies by a unanimous vote of the Council. The meeting shall continue for three days, unless otherwise ordered by a majority vote.

Section II.—Special Meetings.

A special meeting may be called at any time by the President, and it shall be his duty to do so upon the requisition in writing of any seven Fellows.

Section III.—Quorum.

For the transaction of business, any number of Fellows at any meeting shall constitute a quorum. For elections, for changes in the Constitution and By-Laws, for ordering assessments or for the appropriation or expenditure of any sum of money exceeding twenty-five dollars, or for any other business affecting the interests of the Association, fifteen Fellows shall be required to form a quorum. For the expulsion of a Fellow, twenty-five Fellows shall be required to form a quorum.

Section IV.—Duties of President and Vice-President.

The President shall preside at the meetings of the Association, preserve order, regulate debates, sign certificates of Fellowship, approve bills, appoint committees not otherwise provided for, announce results of elections, and perform all other duties legitimately appertaining to his office. In his absence the Vice-President, in order of seniority, shall preside. In the absence of both Vice-Presidents the Chair shall be taken by the senior Fellow (by election) of the Council who may be present.

Section V.—Secretary.

The Secretary shall keep the Minutes of the Association, and shall issue, at least six weeks prior to the annual meeting, a preliminary programme of the time and place of meeting and business to be transacted. He shall also issue the final programme of the annual

meeting, and at the same time he shall issue a list of the names of the candidates for Fellowship that are under consideration by the Council. He shall attest all official acts requiring certification, in connection with or independent of the President; notify officers and Fellows of their election; keep in his custody the seal of the Association and affix it to all documents and papers that the Association may direct; take charge of all papers not otherwise provided for. He shall serve as Secretary and keep Minutes of the meetings of the Council and of the Committee on Annual Meeting.

Section VI.—Treasurer.

It shall be the duty of the Treasurer to receive all moneys and funds belonging to the Association. He shall pay all bills when properly ordered by the Association and countersigned by the President, collect all dues and assessments as promptly as possible, report to the Association at each annual meeting the names of all Fellows in arrears, and who have, in accordance with the By-Laws regulating the same, forfeited their Fellowship. He shall present an annual account for audit.

Section VII.—Recorder.

The Recorder shall receive all papers and reports of discussions on papers presented to the Association, and as the Chairman of the Publication Committee shall take charge of their publication.

Section VIII.—Council.

The Council shall consist of three Fellows elected at large, with the President, Secretary, Treasurer, and Recorder *ex officio*. The terms of service of the members shall be three years, and at each annual meeting one shall be elected to take the place of the retiring member.

Stated meetings of the Council may be held at the call of the President, a majority of the members constituting a quorum.

Special meetings of the Council may be held on the call of the President, or at the request of three members of the Council in the interval between the meetings of the Association.

The President of the Association shall be the Chairman, and the Secretary of the Association the Secretary of the Council.

The Council shall be the executive body of the Association, and accurate Minutes of its proceedings, properly indexed, shall be kept by the Secretary.

All propositions for Fellowship shall be submitted to it for action, and the names of those candidates only who have complied with the requirements of the Association and the rules of the Council, and who shall receive its favorable recommendation, shall be presented to the Association for election as Fellows. It shall act as a Board of Censors for the trial of all alleged offences against the Constitution or By-Laws or unprofessional conduct by any Fellow of the Association, and it alone shall have the power of moving their expulsion.

Section IX.—Committee on Annual Meeting.

The Committee on Annual Meeting for each successive year shall consist of two (2) Fellows elected by the Association, and the President, Secretary, and Recorder *ex officio*, together with the Chairman of the local Committee of Arrangements. The committee shall elect its own Chairman.

The duties of this committee shall be the arranging for the scientific papers and discussions and the general programme of the annual meeting.

An adjunct local Committee of Arrangements of three members shall be appointed by the President from Fellows residing at or near the next place of meeting.

The committee shall have authority, by unanimous action, to invite papers to be read and topics to be presented by individuals outside of the Association.

Meetings of this committee shall be held at the call of the Chairman. The Secretary of the Association shall be the Secretary of this committee, and shall keep Minutes of the meetings.

Section X.—Publication Committee.

The Publication Committee shall consist of the Recorder, Secretary, and Treasurer, of which committee the Recorder shall be the Chairman. They shall have charge of the publication of the volume of Transactions, submitting proof copies of all papers and discussions to authors, or to those taking part in the discussions, before their publication. They shall employ a competent stenographer, to take reports of all discussions of papers on scientific subjects presented to the Association, and to assist the Secretary in keeping the Minutes of the meetings of the Association, of the Council, and of the Committee on Annual Meeting.

Section XI.—Papers and Reports.

All papers and reports read before the Association shall be delivered to the Recorder at the time of their presentation. If the expense of the publication of any paper shall exceed one hundred dollars the cost of publication may, upon the unanimous vote of the Publication Committee, be subject to assessment upon the author. No paper shall be published in the Transactions which has not been read in full before the Association or presented by title, nor elsewhere reported unless full credit is given to the Association.

Section XII.—Initiation Fee.

Every Fellow shall on admission pay an initiation fee of $50.00, by which act he acknowledges and accepts the Constitution and By-Laws of the Association.

Section XIII.—Annual Dues.

There shall be an annual assessment of $10.00, payable on the first day of the session.

Section XIV.—Arrearage of Fellows.

Any Fellow in arrears for one year, being notified of the fact by the Treasurer in writing, and not paying his dues two months thereafter, shall forfeit his Fellowship, and it shall be the duty of the Treasurer to notify the Association of such forfeiture, which shall be entered on the Minutes and the name stricken from the list of Fellows. The notice aforesaid shall contain a copy of this section.

Section XV.—Invited Guests.

Any Fellow may invite any medical man in good standing to a meeting of the Association, and every such visitor shall be introduced to the President, and by the President to the Association, and his name entered upon the Minutes. The President may invite any such person to participate in the discussions, but all invited guests shall withdraw from the executive session.

Section XVI.—Seal and Certificate of Fellowship.

The Association shall have a distinct seal as well as a certificate of Fellowship, to a copy of which, signed by the President and Secretary, every Fellow shall be entitled.

SECTION XVII.—ORDER OF BUSINESS

1. Preliminary addresses.
2. Announcements of local Committee of Arrangements.
3. Admission of new Fellows and introduction of invited guests.
4. President's address.
5. Reading of papers.
6. Verbal communications.

Executive Session.

1. Reading of Minutes of last meeting.
2. Appointment of Auditing and Nominating Committees (first day).
3. Reports of the Secretary, Treasurer, and Recorder.
4. Report of Council.
5. Report of Committee on Annual Meeting.
6. Report of Publication Committee.
7. Reports of special committees.
8. Unfinished business.
9. New business.
10. Election of officers (third day).
11. Election of Fellows (third day).
12. Induction of new officers.
13. Adjournment.

SECTION XVIII.—RULES OF ORDER.

The proceedings of the Association shall be conducted under the usual parliamentary rules of order.

SECTION XIX.—ALTERATION IN THE CONSTITUTION AND BY-LAWS.

No part of the Constitution or By-Laws shall be amended, altered, or repealed except at a regular annual meeting. The suggested amendment, alteration, or repeal in the Constitution or By-Laws shall have been presented at a previous annual meeting, signed by three Fellows. The adoption of the suggested amendment, alteration, or repeal shall be by the vote of three-fourths of the Fellows present.

REPORT OF THE COMMITTEE ON NECROLOGY.

JULES PÉAN.

Born 1830. Died January 30, 1898.

JULES PÉAN, one of the most distinguished Honorary Fellows of the Surgical Association, was born near Château-ulun, France, in 1830. In the beginning of his career he suffered many privations, being compelled to support himself in Paris by coaching his fellow-students in anatomy. In 1853 he obtained the position of resident physician in the hospital, having obtained first position at the *Concours*. He was appointed prosector to the Faculty of Medicine on completion of his term of service, and was made attending surgeon to the Saint Louis Hospital. He soon acquired a great reputation for his operative skill and for his success in operations on the abdominal cavity.

His first ovariotomy was done in 1864, the operation being at that time condemned by the Academy of Medicine as criminal. Shortly after he performed splenectomy—an operation hitherto not done in France. Following these he made a number of valuable contributions to operative surgery, such as vaginal hysterectomy, the method of *morcellement* for the extirpation of large tumors, excision of the larynx, and the prophylactic clamping of bloodvessels. The well-known hæmostatic forceps to which his name is attached were devised by Charrière, but to him belongs the credit of their systematic application in surgical practice. The study of excision of the thyroid gland, and the insertion of stumps of *ebonite* into the periosteum to supply the missing parts of the bone, claimed his attention in recent years.

He was surgeon to the Saint Louis Hospital for twenty years, giving up the position by reason of age limit. He then built the International Hospital, a private institution, where he continued the practice of surgery. He was a most accomplished clinical lecturer, with a finished style of expression, which made his lectures always interesting as well

as instructive. His contributions to medical literature consisted of numerous papers upon various subjects communicated to the learned societies of which he was a member, with eight volumes of his *Lectures on Clinical Surgery*, one-half of which were devoted to the diagnosis and treatment of pelvic tumors.

He was elected a member of the Academy of Medicine in 1887, and nominated Commander of the Legion of Honor at the time of his retirement from the Saint Louis Hospital. His death, caused by pneumonia following influenza, was very sudden, occurring after two days' illness, and caused a great shock to his friends and students.

DAVID WENDEL YANDELL.

Born September 4, 1826. Died May 2. 1898.

Dr. Yandell, an original Fellow and an ex-President of the Surgical Association, passed away at his home in Louisville, Ky., on May 2, 1898. Born at Craggy Bluff, Tenn., September 4, 1826, he was of a family of doctors. His grandfather, Wilson Yandell, was a pioneer physician of Tennessee, widely known in his day; his father, Lunsford P. Yandell, was for many years a medical teacher, for a time at Transylvania, and later in the University of Louisville; and two brothers, Lunsford P., Jr., and William M., were physicians, the first-named holding a chair in the University of Louisville at the time of his death, in 1884. After having been for the preceding six years in Nashville, young Yandell went to Louisville in 1837, and in due time entered upon his medical studies in the home-school, taking his degree in 1846. It was during these years of undergraduate study that there began the friendship that ever afterward existed between the elder Gross and Dr. Yandell—between the "Master in surgery" and "My most illustrious pupil"—a friendship and affection to which we owe the inscription on Prof. Gross's urn, an epitaph than which none more beautiful was ever written in the English language. For two years or more after graduation Dr. Yandell was abroad, and upon his return b gan the practice of medicine in Louisville, his home during the rest of his life, with the exception of a couple of years during which he was, on account of his health, on a farm in Tennessee, and the years spent as a medical officer in the Confederate service. Of his army record he was very proud, and properly so, having been Medical Director on

the Staff of Gen. Albert Sydney Johnston, of Gen. Joseph E. Johnston, and of Gen. Kirby Smith, under all circumstances showing himself a skilful surgeon and a good soldier. Almost immediately after his return from Europe he began his work as a teacher of medicine, organizing the "Stokes Dispensary," and using its material in the instruction of private classes. Before he went into the army he was Professor of Clinical Medicine in the University of Louisville, and soon after his return was appointed Professor of Medicine, transferred to the Chair of Clinical Surgery in 1869, and later to that of Surgery, which he held up to the time of his death. In 1870 he assumed the editorship of the *American Practitioner*, a monthly journal just started in Louisville, and retained official connection with it during the rest of his life, the journal, after consolidation with the *Louisville Medical News*, being known as the *American Practitioner and News*. His interest in medical journalism had begun years before when, during his post-graduate student life in Europe, he was a correspondent of the *Western Journal of Medicine and Surgery*, his letters on "Medical Matters and Medical Men in London and Paris" attracting much attention and being later published in book form. Aside from editorial work and a few addresses he contributed but little to medical literature.

At the San Francisco meeting of the American Medical Association in 1871 he was elected President, and as such was in the chair at the meeting in Philadelphia in 1872. He had already served as Vice-President of the Association, having been elected at the Cincinnati meeting in 1867, largely, doubtless, in recognition of the grace and brilliancy of the speech he had just made putting in nomination for the Presidency his much loved friend and professional father, Prof. S. D. Gross.

In 1889 he was elected President of the American Surgical Association, being in the chair at the meeting in Washington in 1890. The last few years of his life were, on account of ill health, passed in retirement at his home.

Well read in the literature of his profession, a good diagnostician, a skilful operator, and an instructive teacher, Dr. Yandell was in unusual degree an accomplished man of the world. Of commanding presence, a delightful speaker, a wonderful story-teller, an enthusiastic sportsman, he was at home in any company, a favorite everywhere; for his charm of manner, kindness of heart and honesty of purpose, he will long be remembered.

P. S. C.

ADDRESS OF WELCOME.

BY PROFESSOR DE LASKIE MILLER,
CHICAGO.

MR. PRESIDENT AND GENTLEMEN, FELLOWS OF THE AMERICAN SURGICAL ASSOCIATION: By the courtesy of members of your Association, and in compliance with their invitation, I extend to each of you a cordial greeting. To pronounce the words of welcome to the American Surgical Association is a pleasure and a distinguished honor. You are well known in this city. The original and the successful professional work of your membership during the years of your associated activity have inscribed your guild conspicuously in the annals of progress in this country, and secured for you an honorable recognition by the most proficient representatives of your specialty in other lands.

The medical profession of this city appreciates the honor of your presence and unites in extending to you a hearty welcome.

For more than threescore years, as student of medicine and as physician, the speaker has been in close touch with the profession. That length of time carries one back to a period which antedates the use of anæsthetics in surgery.

Having made this confession, Mr. President, with your permission I will premise what I wish to say to your Association with a few brief reminiscences.

I have many times thought that the surgeons of the present period seldom realize that the ease and complacency with which they perform the most difficult operations was an unknown experience in the lives of the most skilful surgeons of the past.

In looking backward I recall the changes and improvements in operative procedures which are due to anæsthesia. One of these I do not remember to have heard discussed, certainly not in later years; I refer to the time consumed in performing major operations. Under

the old *regime* time was considered an important factor; of course, the operation should be done well, but to abbreviate suffering it must be done quickly.

I remember distinctly the first amputation I witnessed. It was performed in the Albany Medical College on one of the earliest days in the existence of that institution. The next day I read in the morning paper: "Yesterday Prof. March amputated a thigh in sixteen seconds." It was usual in giving account of important operations to include the time required in their performance. Not a few acquired great reputation as skilful surgeons, and some even captured fame by the quickness of their operations. It was said of Ferguson that he was the prince of operating surgeons, for he made the knife fly with a rapidity which few could adequately follow.

How different that was from the method of the present time. Now the surgeon proceeds with deliberation and always cuts with precision.

I feel inclined to illustrate my meaning and the possible difference in results, by reference to a case. I have referred to Alden March as a dexterous operator; he was ambidexterous. The notes of the case taken at the time of the operation are printed in the appendix to Cooper's *Surgical Dictionary*, American edition, therefore I need not read them. The following points will serve my purpose. A tumor to be extirpated, size of a pint bowl, situated on the side of the neck. The external incisions were made. In dissecting the tissues from the growth the jugular vein was divided. The patient died on the operating-table. Death was attributed to the sudden inrush of air, probably correctly; though some of the professor's contemporaries insisted that death was caused by the sudden outrush of blood.

We habitually speak of the anæsthetic as a boon to the patient; it is, surely; but have you duly estimated its value to the surgeon? In those days it was common for the patient to approach the operating-table in a state of mental and nervous excitement and dread not unlike that which the convict must have suffered as he approached the guillotine. To shorten the patient's suffering the surgeon would operate with his utmost speed. Consider the surgeon's perplexity caused by the sudden and unexpected movement of the patient, his anxiety as to results, and, if accident occurs, his chagrin. Believe me, I have seen in the operator, results from these causes that were little less than a surgical shock.

At that time laparotomy was considered unjustifiable except in

extraordinary conditions, and then it was performed as a forlorn hope.

Bacteriology formed no part of the curriculum; micro-organisms had not been differentiated. Then the professor could stand before his class and teach that "laudable pus" was the best dressing for an open wound, and his statement would pass unchallenged.

In the early sixties in la Hôpital Lariboisière I witnessed the removal of a cancerous breast of large size by the écraseur. I refer to this case to note three items of fact:

First. Chloroform was administered, but at no time during the operation was the patient unconscious, and her pathetic appeals to Monsieur Chassignac, and her piercing cries, were shocking even to an accoucheur.

Second. No search was made for diseased lymphatics, nor was anything said on the subject to the class then present.

Third. No attempt was made to close the wound. It was stated that the advantage of repair by granulation was, that any cancer cells remaining intact might escape with the discharge. I might add the fourth item: The bliss of the operator may be inferred, for he had no fears of sepsis.

I have not introduced these incidents because I think them surprising or singular, but that they may stand in impressive contrast with the methods of the present time.

Prospero utilized his actors until they had served his purpose; then he confessed—

> "They were all spirits
> And have melted into air, into thin air."

Accepting this precedent as my justification, would I tax your imaginations beyond the degree of propriety if I summon into this presence some of the worthies of the profession, such as the elder Warren, Valentine Mott, Willard Parker, Nathan Smith, Gibson and McClellan, Mussey and Dudley, March and Brainard, and as a historic celebrity, Ephraim McDowell, and consider them reincarnated, and possessing all the learning and wisdom and experience they had acquired before they were translated? As I was personally acquainted with some of those men I crave your indulgence, Mr. President, while I address a few words to these imaginary auditors.

In these days, and in the practice of the Fellows of the American Surgical Association, suppuration does not follow surgical operations;

ovariotomy is one of their frequent operations, and is almost uniformly successful. The Cæsarean operation is performed so successfully that it is undertaken with the confident expectation of the survival of mother and child. The field for the surgeon's knife includes all the organs inclosed in the three great cavities of the human system. When bone is destroyed by necrosis these surgeons cause its reproduction by treatment. When the larynx is destroyed by disease and must be removed, they construct and insert a mechanism that will functionate. Under conditions the human body becomes translucent.

Gentlemen of the Association, verily it doth seem that Deity hath spoken again, and this time to the men of this generation, in the words of the grandest sentence known to our language when its beneficence is considered, saying: "Let there be light," for there is light.

A class of thinkers tell us that our knowledge here is limited, because the space we occupy is known only in three directions; but they kindly assure us that in the fourth space the possibilities of knowledge will be practically unlimited. They affirm, on what they deem evidence which would be proof in a court at law, that there have been a few "who, before they passed the gate of darkness through," have been permitted to see and know the wonders of the fourth space.

I do not apprehend that the ordinary mortals are to be ushered suddenly into the glories of the fourth space, as by the lifting of a veil, or as by the shifting of the scenes in a theatre, nor yet as by the burst of sunlight as the mist is suddenly dispersed. This would not accord with our experience or the laws which govern intellectual expansion.

I have my reasons for the belief, however, that by patient, persevering, and intelligent investigation along the lines which have conducted you to the high plane of success which you now occupy, and on other lines that may be evolved, you will surely find the complete equation of the unknown quantity. A retrospect of only a decade is assuring. In that brief period a description of the discoveries, the inventions and improvements, with the classification of the new terminology in surgery, would fill a volume. Discoveries are made so frequently in our day, that we have come to expect some new one almost daily; and should a week pass by void, we feel some degree of impatience.

Gentlemen, I congratulate you on the triumphs you have achieved. But the end is not yet. Before the close of the nineteenth century,

by the improved technique of surgical practice it should be possible to eliminate from practice a most repulsive operation that has darkened many pages of medical history; craniotomy on the living child should not be recognized as justifiable in the twentieth century.

I read with great pleasure, in the last issue of the *British Gynæcological Journal*, that Professor Charles, of Liege, in ten Cæsarean operations, lost no mother or child; and in the *American Journal of Obstetrics*, Dr. Reynolds points out that, at the Boston Maternity, there have been, in twelve years, twenty-two Cæsarean sections without the loss of a single mother or child. Why waste more time in struggling with symphysiotomy?

I see in the perspective of the vista that lies before you the promise of many important improvements, some but dimly outlined and shadowy, others assuming tangible form. Shall the antitoxin for cancer be the next demonstration?

I speak the words of sober inference. Standing as you are in the approaching dawn of the twentieth century, you are to become familiar with actualities which the eye hath not seen nor the ear heard, neither hath it entered the mind of man to imagine.

If I may, I would respectfully admonish your Association, that while you are engaged in exercising your extraordinary skill in relieving suffering humanity, do not omit another mission which is important.

Your influence may inspire the young men who are to become your successors with the spirit of investigation. Their success in that work will depend on a proper equipment. The higher education for them in that rôle is an essential factor. A thorough and broad familiarity with general and applied science should form the foundation for entrance upon professional study; only by such preparation can they profitably begin the work of original research. Moreover in this day, and in all the future, they should realize that to attain a respectable recognition in the medical profession all these preliminaries must be mastered.

I am not unmindful of the fact that I am speaking to military surgeons, and should I make no allusion to the great work of our army surgeons in the recent conflict with Spain I would expect you to challenge me for criminal indifference. My impulse is to say much on the importance of that work and of its brilliant execution in the campaign in the West Indies. I realize, however, that the canons of good taste would not permit me to consume your valuable time with many details.

I was not at the front, and should I detain you for an indeterminate length of time, all that I might say would resolve itself into a brief summary. I may, at least, say that the surgeons of that campaign are entitled to credit for good works and efficiency outside the usual routine of professional duty. Instances that would confirm this statement abound; I need not enumerate them.

When camps were located without consulting the medical departments, the surgeons-in-charge found it necessary not infrequently to advise a change of location for sanitary reasons. The timely warning often given by the surgeons that the spread of malignant disease in the camp was imminent saved the lives of unknown numbers of soldiers.

The successful generals were those who consulted with their surgeons and followed their advice.

The surgeons who voluntarily exposed their lives to the dangers of the camp in that insalutary climate, and heroically on the field of battle, and gave their skilled services to the sick and wounded soldiers unstintingly at all times, and treated all kindly, tenderly, and encouraged the desponding with cheerful, hopeful words, as we know they did, are deserving from the American people encomiums to the limit of language. In this noble work your Association was conspicuously represented.

Gentlemen, I would reassure you that the physicians of this city will feel happy when they know that your visit to this, your annual meeting, has been a pleasant and profitable one to you.

RESPONSE TO THE ADDRESS OF WELCOME.

By W. W. KEEN, M.D.,
PHILADELPHIA.

PROFESSOR MILLER: I beg to return our heartfelt thanks to you, as the representative of the profession of Chicago, for this cordial welcome. I am sure, gentlemen, that in all respects Professor Miller's address is unique among us here. I do not think that there is probably another man in the room who is so much of a Nestor in the profession that he can go back to pre-anæsthetic days, and I am tempted to recall to your mind a fact which I learned only very recently from Dr. Warren, that in the five years preceding the introduction of anæsthesia the total annual number of operations done in the Massachusetts General Hospital was thirty-seven in an entire year, or about three a month. In the last year over thirty-seven hundred operations were done in that same hospital; and in the Jefferson Hospital, with which I am connected, I have known of as many as nineteen operations to be done in a single day. Nothing, I am sure, could be more striking than this statement of the relative frequency of operations. In another respect, I am sure also that this welcome is a notable one. No one could have made a more graceful introduction to our meeting, and all of us wish, when we reach Professor Miller's age, that we may have his beautiful faculty and facility of speech and his exquisite manner. I thank you, sir, on behalf of the American Surgical Association. (Applause.)

ADDRESS OF THE PRESIDENT.

THE TECHNIQUE OF TOTAL LARYNGECTOMY.

WILLIAM WILLIAMS KEEN, M.D., LL.D.,
PHILADELPHIA.

ALL surgical operations are subject to the law of evolution. This is especially true of the rate of mortality, which, in the early days of every new operation, is apt to be very great, but progressively diminishes as we learn the errors that have attended the technique.

I have been ill satisfied with the usual technique of laryngectomy, and as in a recent case I adopted a method which rendered the operation one of simplicity, caused but little loss of blood and little shock, and avoided the danger of aspiration pneumonia, I venture to bring it before the Association, in the hope that it will be tested by others, so as to determine its real value. Instead of being a very severe and dangerous operation, as it has hitherto been regarded, I hope this will place it in the category of safe operations. Certainly, it would seem that an operation in which the patient was out of bed on the fourth day, and was practically well on the tenth day, entire union by first intention having been secured, may be so classified.

Nearly all authors, whether surgeons or laryngologists, speak of the operation as an extremely severe and dangerous one, and this view is warranted by its past high mortality.

Thus Rutsch[1] speaks of the "recovery as very doubtful." Sendziak ("Die bösartige Geschwülste des Kehlkopfes," Weis-

[1] Deutsche Zeitschrift für Chirurgie, 1899, l. 484.

baden, 1897) states that up to 1881[1] thirty cases had been operated upon with seventeen deaths, a mortality of 56.7 per cent.. and that in all the thirty there was only one definitive cure—that is, in which three years or more had passed without recurrence. Later statistics, fortunately, have proved progressively more favorable. Thus Sendziak (p. 160) tabulated, from 1873 to 1894, 188 cases of laryngectomy for carcinoma. The results are:

1. Recurrence, 32.45 per cent.
2. Relative cure (less than three years), 6.9 per cent.
3. Definitive cure (three years or more), 5.85 per cent.
4. Death, 44.7 per cent.

Schmiegelow[2] has tabulated fifty cases of total laryngectomy from 1890 to 1897, and these still later statistics are far more encouraging. His table shows:

1. Recurrence, 20 per cent., a fall of 12 per cent. from Sendziak's table.

2. Relative cure, 48 per cent., a rise of 41 per cent. from Sendziak's table.

3. Definitive cure, 10 per cent., nearly double that of Sendziak's table.

4. Death, 22 per cent., one-half that of Sendziak's table.

The mortality, it will be observed, therefore, has been halved and the definitive cures doubled, as compared with Sendziak's statistics. Were the cases occurring from 1890 to 1894 excluded from Sendziak's statistics the relative difference would be even more favorable.

The causes of the mortality are chiefly (*a*) weakness of the patient by reason of the disease, the poor aëration of the blood, and the entrance of septic discharges from the diseased larynx into the lung before the operation; (*b*) shock, including hemorrhage, during the operation; and (*c*) after the operation septic pneumonia, due to the aspiration of infected wound fluids. This is the greatest danger of all. The sources of these wound fluids

[1] Most German authors entirely ignore the very first case, which was done by Patrick Heron Watson, of Edinburgh, in 1866.

[2] Annales des Maladies de l'Oreille du Larynx, etc., April, 1897.

are twofold: First, the tracheotomy wound, if, as is usual, tracheotomy has been done; and, secondly, the wound left by the removal of the larynx. These wound fluids are usually infected from the food, the secretions of the mouth, and the packing by iodoform gauze, which renders primary union impossible.

While the method which I shall describe does not obviate the weakness or any other unfavorable influence from the general condition of the patient prior to operation, it minimizes the other causes of death, and especially the possibility of pneumonia.

I cannot claim originality for any one of the steps, for they have all been employed, I believe, by others. Thus Bardenheuer[1] closed the communication between the trachea and the pharynx, but he only kept it closed until the wound became covered with granulations and complications were no longer to be feared, say fourteen days. The communication was then reopened for the insertion of an artificial larynx. After adopting this method he had had four recoveries, while by the former method he had had four deaths. Cohen united the stump of the trachea to the skin,[2] one of the most important improvements in the technique, since it prevents in a large measure the access of wound fluids to the lungs. Other surgeons also have used the Trendelenburg posture, etc. But as a systematically planned operation, combining many advantages, the present technique as a *tout ensemble* may be called original.

1. The general preparation of the patient is the same as for any other operation.

2. Preliminary disinfection: As in all cases about the mouth, nose, pharynx, and larynx, I am particularly careful to make a systematic attempt, for two or three days beforehand, to secure at least partial disinfection. While partial disinfection is not as good as complete, yet the results in the treatment of fractures of the base of the skull, in the extirpation of rectal tumors, etc., shows its great value.

[1] Archiv für klinische Chirurgie, 1891, xli. 561.

[2] Transactions of the Philadelphia County Medical Society, 1892, xiii. 302.

I have the teeth very carefully cleansed by the toothbrush. If there are any old stumps of teeth present it is better that they should be extracted, and the operation deferred a few days until these dental wounds heal. For two or three days before operation, every two hours, while the patient is awake, I have the mouth and each nostril sprayed separately with a solution of boric acid, listerine, or both.

3. Tracheotomy: Nearly all authors recommend a tracheotomy either as the first step of the operation or more frequently ten to fourteen days before operation. In the few cases in which dyspnœa is great I should be disposed to do a tracheotomy, say two weeks before the laryngectomy—not, however, with a view of preventing the entrance of blood and wound fluids into the lungs by the introduction of a tampon canula, but for the purpose of improving the general condition of the patient. In the case which is the basis of this paper I did a tracheotomy at the time of operation, but removed the tracheal tube at the termination of the laryngectomy, immediately closed the wound in the trachea, and obtained absolutely primary union. In any future case I am strongly of opinion that it will be better to omit tracheotomy entirely, as I shall show it is not, in my opinion, needful, and by omitting it we would eliminate one cause of septic pneumonia.

4. Posture: The entire operation, after the trachea is invaded, is done with the patient in the Trendelenburg position. I am quite persuaded that the majority of surgeons do not appreciate to its full the advantages which this posture possesses in all operations about the upper air-passages. As I have pointed out in a previous paper,[1] I employ it in epithelioma of the lip, in extirpation or other operations on the upper and lower jaw, in removal of the tongue, in cleft palate, in operations on the tonsils and pharynx, and all similar operations. Blood will not run up hill any more than water, hence, if we employ this posture in laryngectomy, we avoid one of the chief reasons for tracheotomy and the employment of a tampon canula.

[1] Annals of Surgery, July, 1897.

The disadvantages of tampon canulæ are very great—so great that Kocher also has lately dispensed with them entirely. The three most commonly used are those of Trendelenburg, Hahn, and Gerster. Of the three, Gerster's, in my opinion, is distinctly the best. It can be more accurately adapted to larynxes of varying sizes, and is much less likely to injure the parts either by undue pressure or by difficulty of introduction. In one case, in my attempts to introduce a Hahn canula, the rings of the trachea were considerably torn. The objections to Trendelenburg's canula are arrest of respiration, which sometimes follows its introduction, the production of pressure gangrene in the trachea, obstruction to the lower end of the tube by the rubber ballooning into the trachea beneath it, the bursting of the rubber or its being cut, and if none of these mishaps occur, the air often gradually escapes, and thus renders it useless.

The Hahn canula cannot be made aseptic so easily as the others; and as Lennox Browne has pointed out, it requires sometimes twenty minutes for the expansion of the sponge after its introduction.

5. Anæsthesia: This is done at first through the mouth. and is so continued until the larynx or trachea is invaded. A large tracheotomy canula (twelve millimetres in diameter) is then introduced and held in place by disinfected tapes tied around the neck. The inner tube of this canula is removed and the metal tube of a Hahn canula, which precisely fits it, is introduced. A rubber tube connects this with the ordinary funnel for the administration of chloroform.

6. The operation proper: I shall describe the operation in connection with the case herewith reported, and then shall indicate the improvement in technique which I purpose adopting in the next case I may have.

7. The after-treatment.

(*a*) *Posture.* The patient is kept in the Trendelenburg position by placing a chair under the foot of the bed. This posture prevents any wound fluids from running down (or rather up) into the lungs. This position is to be maintained for one day or longer if required. On the second day the bed is lowered

to the horizontal plane. On the third day he is allowed to sit up in bed on a bed-rest, on the fourth to get out of bed and sit in a reclining chair, and on the fifth day he may walk about the room.

(*b*) *Food.* For two days nutritive enemata only are to be used. After that a teaspoonful of liquid food is given, at first every half hour, always followed by a tablespoonful of sterile water, to wash away any food that might possibly leak into the laryngeal wound. At the end of a week full diet as to quantity may be given, but no solid food is to be given until the tenth day. No catheter or œsophageal tube is required. The present patient could swallow from the very first.

(*c*) *Dressing.* The primary dressing will be described in connection with the case. On the day after the operation the small gauze drain is to be removed. Half of the stitches may be taken out on the fourth day and the remainder on the sixth day. In the case here reported the temperature on the day after the operation rose to 101.8° F., and fluctuated between the normal and 101° for a week, when it fell to the normal.

8. Objections.

The only objection to this method which occurs to me is that it absolutely precludes the use of any artificial larynx. But the possession of voice is nothing when compared with a speedy recovery and a greatly diminished danger of a fatal result. Rutsch[1] believes that such a larynx is very unsatisfactory.

Of course, I recognize the fact that one case does not prove the value of any method, but its advantages were so striking in this case that, as laryngectomy is a relatively rare operation, I have not thought it best to wait until I could accumulate a much larger experience before bringing it to the attention of the profession.

9. Final results.

Of course, it is too early yet to draw any inference as to the possibility of recurrence in this particular case; nor is this my purpose. My intention has been rather to demonstrate a

[1] Loc. cit., 485.

method of laryngectomy which would diminish more especially the immediate mortality of the operation and secure speedy recovery by primary union. The chances of recurrence are no greater, nor yet any less, after operation by this method than by any other. This particular patient has been able to go out in all weathers during the past extremely severe winter, though living as far north as Waterville, Me., where the thermometer has been many degrees below zero.

He writes me under date of May 1, 1899, that he cannot sing and is not a success as a whistler. As to his voice, he is able to speak loud enough to be heard at a distance of at least twenty feet, provided there is not too much noise. The day he wrote me his wife went into the next room, and at a distance of twenty-two feet she understood the following sentence: "The weather seems to be unsettled, but I think that we shall have showers before the day is over," with the exception of the word "unsettled," as to which she was not quite sure. Several other sentences were also well understood. He seldom uses his writing-pad in communicating with members of the family. Strangers do not understand him as readily as those who are accustomed to talk with him. He takes part in reading the Scriptures at family prayers, and sometimes himself leads in prayer.

It was clearly an error to abandon to themselves the silk sutures which attached the trachea to the skin. These were drawn down below the level of the skin and so rendered somewhat inaccessible. They should have been either of slightly chromicized catgut or fine kangaroo tendon, which I think would have been the best. If of silk, they should be removed by means of the laryngeal mirror at the end of a week or ten days. The silk stitches which I left have annoyed him somewhat ever since. When Dr. Freeman examined him, on October 19th, no evidence of the stitches was found; but Dr. Bessey removed three on the 24th, another on the 26th, and on November 28th part of a fifth. A small sinus still persists at this point, probably due to a retained portion of the silk suture.

The tracheal tube is only worn at night. He still finds that

if it is omitted for any length of time some contraction of the orifice takes place.

His general condition is excellent. His weight, 133 pounds, is normal, and he is in much better health than before the operation.

CASE.—The Rev. Dr. S., aged fifty-nine years, a missionary in Burmah for many years, first consulted me by letter in the early autumn of 1897. He had done a great deal of open-air preaching, naturally causing a great strain on his voice. About five years before, after an attack of grippe, he observed that his voice at times cracked. A year and a half ago this became more pronounced, and at the instance of his physician he refrained from using his voice for six months. After three months' rest it was so much better that he resumed his preaching, only to break down again very soon. About a year before he saw me hoarseness began, and this was the principal feature which then annoyed him. I wrote to him, advising that he should come to this country at once, as I feared he was suffering from a malignant growth. He reached Philadelphia May 16, 1898. On laryngoscopic examination I found a papillomatous growth on the right vocal cord, which, I feared, was the early stage of epithelioma. I sent him to Dr. Walter J. Freeman for examination May 23d. He removed fragments of the growth, which were sent to Dr. D. Braden Kyle for microscopical examination. Dr. Freeman's report is as follows:

"I found a large, rough growth occupying all the upper surface of the right vocal cord. It was distinctly epithelial in character, and there was little doubt as to its malignant nature. I removed two pieces with forceps. One piece of the growth was superficial; the other was quite a large piece, running well into the growth."

Dr. Kyle's later report is given below. It confirmed the diagnosis of epithelial carcinoma.

First Operation. Thyrotomy, May 25, 1898. The patient was placed in the Trendelenburg position, which was maintained throughout the entire operation. An incision was made in the middle line, from the hyoid bone to the first ring of the trachea, directly down to the cartilages. After securing every bloodvessel, I divided the thyroid cartilage by a pair of stout scissors precisely in the middle line. The two halves of the cartilage were then held widely apart by re-

tractors. I found that it was not necessary to divide the cricoid, but that I could obtain ample room for manipulation by simple separation of the two halves of the cartilage. The growth was limited to the right vocal cord, and extended three millimetres below it. I therefore divided the mucous membrane anteriorly and posteriorly by two vertical incisions and by two horizontal incisions, the one above and the other below the vocal cord, and outlined a quadrangular flap down to the cartilage. Beginning then anteriorly, this was dissected down to the cartilage itself. Quite free hemorrhage took place from the divided mucous membrane, which was controlled partly by pressure with iodoform gauze and partly by hot water, which, in the Trendelenburg position, could be used freely. Two vessels were tied. The small fragments of tissue still left attached to the cartilage I curetted away. The right arytenoid cartilage was also removed. The hemorrhage was so slight at the end of the operation that I closed the laryngeal incision entirely by catgut sutures, through the external soft parts and the perichondrium. When he was placed in bed the pillow and bolster were removed and the foot of the bed was elevated on a chair. He breathed with perfect ease. No food was given by the mouth for twenty-four hours, but four rectal nutritive enemata were administered. On the fourth day his temperature rose to 101.4° F. It then slowly fell to the normal by the fifth day. Slight suppuration took place in the lower portion of the external wound, where a small stitch-abscess developed. He went home June 6th, and three weeks afterward the wound was entirely healed. After this operation Dr. Freeman examined the larynx and reported as follows:

"On the 5th of June I again saw the patient, after the first operation. There was a large ulcerating surface on the right side of the larynx, with considerable swelling of the surrounding mucous membrane, but no trace of the original epithelial growth. The left ventricular band was swollen, or rather ballooned out over the cord and concealed it. On making a forcible 'a,' the band collapsed and the cord below it then came into plain view."

Both before he had seen me personally and after he returned to Waterville, Maine, which was his home, he was under the care of Dr. Bessey, of that place, and owes very much to his intelligence and skill.

In September, 1898, Dr. Bessey wrote to me that a suspicious spot had appeared at the site of the former operation. Accordingly Dr.

S. came to Philadelphia, and Dr. Freeman and I both examined him in October, finding a distinct growth which had crossed the middle line and invaded the left side. Accordingly, I advised a total laryngectomy.

Second Operation. Total laryngectomy, October 4, 1898. The patient was placed in the Trendelenburg position and an incision was made in the median line, in the scar of the old thyrotomy. The thyroid cartilage was again split and the two halves drawn apart to determine by inspection whether a total or unilateral laryngectomy was required. Having decided upon a total laryngectomy, I dissected away the soft parts from the entire larynx, keeping very close to the cartilages, and continued it till I reached the œsophagus posteriorly. All hemorrhage was carefully arrested by catgut ligatures. The median incision in the skin was then carried down nearly to the sternum, but the soft parts were only separated down to the cartilages. A low tracheotomy was now done; but, instead of any tampon-canula, I inserted a large ordinary tracheotomy tube, the calibre of the outer tube of which was twelve millimetres in diameter. The inner tube was removed and the metal tube of Hahn's canula was inserted and connected with its chloroform apparatus. Prior to this time chloroform had been administered by the mouth.

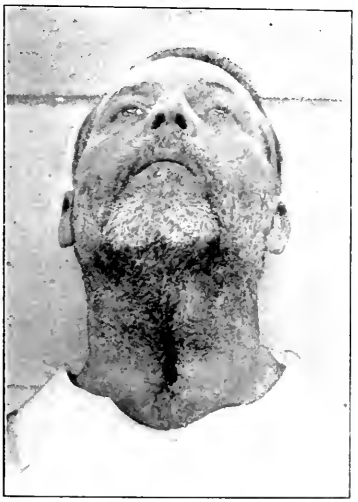
The trachea was now divided completely across, below the level of the cricoid and below the lower border of the beard. The lower end of the portion to be removed was then drawn forward by a hook, and chiefly by the finger, but with the occasional assistance of the Allis dissector I very carefully separated the larynx from the œsophagus up to the upper level of the larynx. By a few snips of the scissors I was then able to divide the attachments of the upper margin of the larynx horizontally and removed it. The epiglottis was drawn down through the median incision and removed. A few vessels were tied with catgut.

The upper edge of the anterior wall of the pharynx was then carefully attached to the tissues, just below the hyoid bone, by interrupted silk sutures, placed very close together. I thus hoped to shut off entirely the secretions of the pharynx and mouth from the operation wound. The upper end of the trachea was now united to the skin by silk suture. The tracheotomy tube was then withdrawn and chloroform was administered on a pledget of cotton covered with a layer of gauze, held in a pair of ring-forceps over the open end of the

trachea. The tracheotomy wound was then immediately closed by catgut sutures to the trachea, and silkworm-gut sutures closed the corresponding wound in the skin. The wound above the tracheal opening, at the former site of the larynx, was also closed by silkworm-gut sutures, a small gauze drain being inserted in the lower end. The amount of blood lost during the operation was less than three ounces.

The wound was dressed as follows: Narrow folded strips of gauze were placed above and below the tracheal opening, which was left bare. To protect the wound from infection, if possible, and certainly from dust, the body of a disinfected wooden pill-box, from which the top and bottom had been removed, was placed over the tracheal opening, and over the pill-box two or three layers of gauze were laid and pinned to the dressing on each side, the object being to filter the air. From time to time the gauze and pill-box were removed, so as to remove any discharge from the margin of the tracheal opening.

FIG. 1.



Showing the wound ten days after total laryngectomy.

The entire operation of tracheotomy and laryngectomy occupied an hour and a half. At the end of the operation his condition was very satisfactory. He was placed in bed in the Trendelenburg position,

without pillow or bolster. The day after the operation the temperature rose to 101.8° F., and for a week fluctuated between the normal and 101° or lower, and then fell definitely to the normal. For twenty-four hours he was kept in the Trendelenburg position. On the second day the bed was placed level, and on the third day he sat up in bed with a bed-rest. On the fourth day he was out of bed. For the first thirty-six hours he was fed by the rectum. After that he took a teaspoonful of liquid food every half hour by the mouth, this being always followed with a tablespoonful of water to wash away any food which might get into the pharyngeal wound, as I was not sure of obtaining primary union upon that point. At the end of the week he was on full diet as to quantity, though none of it was solid food. On the tenth day the photograph (Fig. 1) was taken, and he was well enough to go home, but as he had to travel between 300 and 400 miles, I thought it best for him to remain for a few days longer, lest any unforeseen complication should arise.

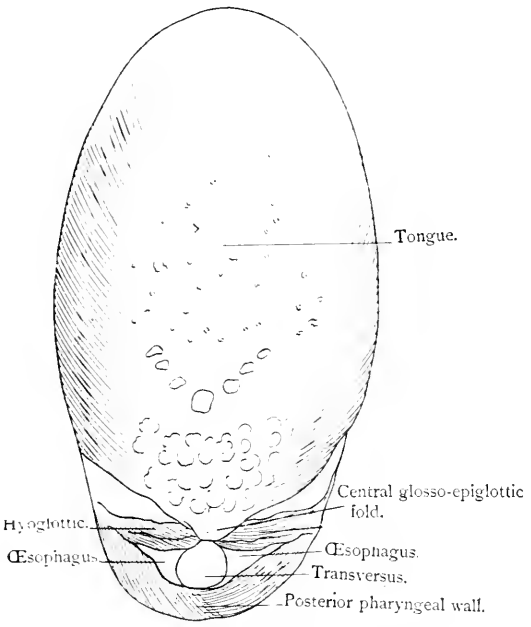
The entire wound united by first intention. The gauze drain in the wound left by the removal of the larynx was removed at the end of twenty-four hours. For the first four days no tube was placed in the upper end of the trachea. Finding by that time that the tracheal opening was contracting, I introduced the tube, but placed it entirely under his own control, so that he wore it off and on, according to his needs. The skin was somewhat drawn into the opening, showing the need of cutting off the trachea below the level of the beard. The sutures which attached the trachea to the skin were thus drawn slightly into the trachea, but I left them to take care of themselves. This was a mistake, as has been shown.

On October 19, 1898, fifteen days after the operation, he went to Dr. Freeman's office. The following report of the condition, with the accompanying sketch of the appearance of the parts as seen by the laryngeal mirror (Fig. 2), were made by Dr. Freeman:

"I found Dr. S.'s throat in perfect condition. There is no point of suppuration or ulceration, or even of abnormal redness. You asked me to examine especially for extruding sutures. There is nothing of the kind to be seen anywhere. The oropharynx slopes down funnel-shaped in the normal direction, and at the bottom lies a white, round mass, the size of a large marrowfat pea, which I take to be the contracted transversus muscle. Above this and running from the base of the tongue to the sides of the pharynx are folds, which, I think, we

may with propriety call hyoglottic, containing, as they do, fibres of the hyoglossus muscle. Between the inner ends of these lies a projection, the remains of the central glosso-epiglottic fold." (Fig. 2.)

FIG. 2.



Appearance of the parts as seen in the laryngeal mirror after total laryngectomy. (FREEMAN.)

Dr. Kyle's report as to the microscopic findings was as follows:

"Section of papillomatous growth from vocal cord, taken from one of a number of papillomatous projections from a mass involving the right vocal cord and infiltrating the tissue below. This portion was removed by means of a biting-forceps for the purpose of microscopic examination. From all appearances it is papillomatous, but clinically it had the history and appearance of carcinoma. Subsequent laryngectomy proved it to be carcinoma, this tissue being merely a papillomatous projection on the mucous membrane surface

of the carcinoma, showing how easily the mistaken diagnosis of papilloma followed by carcinomatous change might be made. (Fig. 3.)

FIG. 3.

Section of the growth removed before the first operation. (KYLE.)

"Sections of the vocal cords, perpendicular to the surface and parallel to its long axis, from the specimen removed at the laryngectomy, showed a layer of thickened epithelial cells, dense in places

FIG. 4.

Section of the growth removed by total laryngectomy. (KYLE.)

and infiltrating the connective tissue beneath, forming small nests. The connective tissue was thickened, as a result of inflammatory infiltration, with partial organization. (Fig. 4.)

"The arytenoids showed much the same process, though in a less degree. Some of the smaller portions of tissue from the deeper structure showed no infiltration.

"*Diagnosis.* Epithelial carcinoma."

A further improvement can be made in the technique—viz., the omission of any, even a temporary, tracheotomy. In my next case, after dissecting the soft parts from the larynx and upper trachea back to the œsophagus on both sides, I shall place the patient in the Trendelenburg position and deepen the narcosis to a slight extent. I shall then divide the trachea transversely, and by three sutures, one in the middle line and one on each side, I shall quickly attach the tracheal stump to the skin. Then I shall introduce the ordinary tracheotomy tube into the open end of the trachea, instead of through a tracheotomy wound, and continue the anæsthetic through the tube. The later steps of the operation will be the same as above described. In order not to embarrass the operator the flange of the tracheotomy tube should only project at the sides, as the usual wide upper border of the flange would interfere with access to the parts at the beginning of the removal of the larynx.

FIRST-AID PACKAGE IN MILITARY SURGERY.

By N. SENN, M.D.,
CHICAGO.

It is fortunate for the armed forces of the world, unfortunate for military surgery, that no great wars have occurred since antiseptic and aseptic surgery came into general use. During the time the Franco-Prussian war was fought, the last great war since our own great civil war, Lister was quietly at work framing the great principles which have recast the work of the surgeon. Antiseptic and aseptic surgery have not had, as yet, an extensive and fair trial on the battle-field. Carbolic-acid solutions were employed to some extent by the German surgeons during the Franco-Prussian war, but Billroth's extensive observations in a number of large military hospitals led him to the conviction that they did not exert any special influence in the prevention of wound complications. So late as 1861, Strohmeyer advised, in his classical work on *Military Surgery*, the use of the wet compress in the treatment of wounds on the battle-field, a method of treatment that had been in use from time to time since military surgery was practised. The only innovation was a gutta-percha tissue cover over the compress, which was used for the purpose of retaining moisture until the patient could reach the field hospital, where the compress could be changed as often as was deemed necessary. This treatment was a decided improvement over some of the old methods, such as the common practice of tamponing wounds with infected charpie and the barbaric use of boiling oil; but it was a step backward, judging from the present stand-point of wound infection, from the treatment of wounds by the local use of turpentine, which at one time was sanctioned and extensively prac-

tised by German military surgeons. The moist septic compress had a trial on the most extensive scale during the civil war, and we are familiar with the results. The terrible experience with gunshot-wounds by all the old methods of treatment turned the attention of all military surgeons to the modern treatment of wounds as soon as it became well established in civil practice. The surgeons in civil life built the bridge across the river which separated the old from the new methods of wound treatment, and the military surgeons willingly followed the advance columns crossing it, eager and anxious to extend the benefits of the new discovery to the wounded soldier. The wars among civilized nations have been too few and on too small a scale to perfect the technique of aseptic surgery on the battle-field; a sufficient experience has, however, accumulated to warrant the statement that asepsis will eventually bring about as great changes in military surgery as it has already accomplished in civil practice. The first tentative efforts to practice asepsis in military surgery were made during the Russo-Turkish war. Reyher and von Bergmann, who took a conspicuous part during that campaign, made known promptly the results of their observations, and their writings laid the foundation for the modern treatment of gunshot-wounds. Two things were brought out clearly during that war—viz., the value of a first-aid antiseptic occlusive dressing in the prevention of wound-infection and the importance of immediate immobilization of gunshot-fractures.

It was during that war, too, that the too common practice of searching for and extracting bullets on the battle-field and in the hospitals was violently opposed and strongly condemned by both Reyher and von Bergmann. The value of antiseptic and aseptic precautions in military practice has been demonstrated since that time on a limited scale in Bulgaria, Servia, Chili, Greece, Turkey, Japan, and at different points in Africa in small engagements between the British, Italian, and French troops and the natives, and lastly during the recent Spanish-American war. It is evident that aseptic military surgery will never equal in its results aseptic civil surgery, owing to circum-

stances over which contending armies and governments have no control. Military surgery is and always will be emergency surgery. The difficulty in obtaining and transporting the necessary medical supplies, and in large engagements the number of wounded, render it impossible to follow out the aseptic precautions with the same pedantic care as in private and hospital practice. Absolute asepsis in military surgery on the field is out of question, for reasons that are apparent to anyone who has taken part during an active campaign. The limited experience of the past has, however, shown that the imperfect aseptic precautions which are applicable in the field have done much to minimize the horrors of war.

The modern small-calibre bullet inflicts wounds which are particularly well adapted to successful treatment by a primary antiseptic occlusive dressing. All civilized nations have taken advantage of the modern treatment of wounds in their efforts to extend its benefits to military surgery. Suggestions from different sources in this direction came soon after antiseptic surgery became generally a recognized procedure. It is interesting to know what has been done in the way of recommendations for asepsis on the battle-field. Antiseptic powders, sterile and medicated cotton, gauze, wood-wool and other hygroscopic substances have been proposed. As antiseptics, iodoform, salicylic acid, carbolic acid, mercuric chloride, zinc chloride, and salol have been most frequently mentioned and used. The many difficulties which are met with in war in the transportation of medical supplies make it necessary to restrict the requirements for procuring and maintaining asepsis as much as is compatible with the immediate demands of the principles upon which it is based—that is, asepsis on the battle-field must be attempted by the employment of the most efficient and simple precautions.

The value of the first-aid dressing applied behind the fighting line by the wounded himself, his comrades or members of the hospital corps, is as yet not generally admitted. Legouest, Delorme, Niemir, French military surgeons, do not favor the first-aid package. Chauvel does not share their view, and

makes a strong plea for its general introduction into military practice. But until 1889 no such packages were in use in the French army. Patin suggested the following first-aid package: One elastic bandage, one antiseptic gauze bandage, two graduated compresses of the same material, enclosed first in paraffine paper, and as a cover strong paper made waterproof by linseed oil, and a siccator. Bedoin proposed as a dressing-material for first-aid, filtering paper sterilized by dry heat and immersion in a 1 to 1000 bichloride solution, to which a little glycerin is added, when the paper is slowly dried. Six to eight layers are applied over the wound, besides cotton, and the dressing held in place by a bandage. The package which he recommends for service in the field contains six sheets of aseptic filtering paper, 40 cm. square, properly folded, a piece of gutta-percha tissue, 45 cm. square, in which the paper is wrapped, a thin rubber bandage, from one to one and a-half metres in length, and several safety-pins. The package weighs 40 grammes.

Forgue recommends iodoform and cotton as an occlusive first-aid dressing.

The first-aid package of the French army in use at the present time is quadrangular in shape, the gray cloth wrapper bearing on one side printed directions for use. It is opened by extracting the thread used in sewing the wrapper. It contains an impermeable fabric, a small cushion of sublimated jute, a sublimated gauze compress bandage, and two safety-pins.

Mosetig v. Moorhof advises dusting the wound with iodoform, over which a gauze compress is supplied, then mackintosh or some other impermeable material, which is made to overlap the gauze for at least an inch, and over this a large hygroscopic dressing and bandage.

Wein recommends iodoform gauze between two layers of hygroscopic cotton wrapped in gutta-percha tissue in a compact package. Before applying the dressing it is to be immersed in a strong solution of mercuric chloride, or a carbolized solution, to ensure absolute asepticity, when the iodoform gauze is applied next to the wound, and over it the cotton, gutta-percha, and, lastly, the retaining bandage. Langenbuch advocated

strongly the closure and sealing of the wounds by suturing and adhesive plaster, a part of the field-service which he wished to assign to the litter-bearers. Lübe believed that this method of dealing with gunshot-wounds would prove more effective if the wound were first dusted with iodoform or salicylic acid.

Port has modified the recommendations of Langenbuch in so far that he applies the adhesive plaster in the form of a Maltese cross, with a central opening the size of the bullet-wound, which, when the plaster is in place, is covered with iodoform gauze and cotton for the purpose of guarding against retention of wound-secretions. The margins of the gauze dressing are sealed to the surface with a rubber solution, and the whole retained by strips of adhesive plaster. In 1869, v. Esmarch devised the triangular bandage, with printed illustrations for its use. During the early history of antiseptic surgery, he recommended balls of zinc, chloride jute, and later wipers of sublimated sawdust in gauze bags, for the field-service. His typical first-aid package was a later product of his fertile brain. It consists of his bandage, two compresses of sublimated gauze, 10 cm. broad and 100 cm. long, each wrapped in waxed paper, and an antiseptic cambric bandage 10 cm. broad and 2 metres long. The whole package in rubber cloth weighs 100 grammes. According to Seydl, the first-aid package of the German army in 1893 contained a sublimate gauze bandage, 5 metres in length, two compresses of the same material, one safety-pin, the whole wrapped in a compact form in waterproof linen cloth, which is sewed into the skirt of the uniform of officers and men.

In 1885 an order was issued in England from the medical department which required that a field-dressing should form a component part of every British soldier's kit in active service, so as to be available at all times and in all places, as a first-dressing for wounds. The materials and form of the first field-dressing were ordered to be as follows: Bandage of fine calico, 4 yards long, 3 inches wide; fine lint, 12 inches long, 3 inches wide; folded flat and flattened by four pins. It was ordered to be carried in the soldier's knapsack. During the Ashanti war, 1873–74, the dressing included a packet of lint, on which a little

simple ointment had been spread, enclosed in waxed paper; a triangular bandage, two safety-pins, and a small packet of ordinary pins. The whole of these articles were folded into a small flat package, 4 inches by 3½ inches by 1 inch in dimensions, which was covered by waxed paper. It was carried in a breast-pocket, which was made of suitable size to contain it, in the lining of the left side of the tunic. Later this package was ordered to be carried with a sewn-up pocket on the inside of the skirt of the soldier's jacket. Since 1891 the package is made up as follows: Within an outer gray fine linen cover is a thin waterproof cambric inside cover, which is rendered air-tight by being cemented at the edges. Both covers can be readily opened when necessary. The inner cover contains two safety-pins, a piece of waterproof cambric, 12 inches by 6 inches, and this encloses a gauze bandage, 4½ yards long, folded flat into a package, 4 inches by 2½ inches, a piece of gauze, 17 inches by 13 inches, also folded flat, and about 160 grains of compressed flax charpie between layers of gauze. All the dressing-materials are rendered antiseptic by impregnation with mercuric chloride, 1 in 1000. The weight of the complete dressing is 2 ounces.

Metallic cases have been recommended for the safe-keeping of the dressing-materials by Majewski, Port, and others. Port suggested a piece of tin which, when folded, would be about the size of an ordinary envelope, and which was to be sewed into the uniform over the region of the heart, for the double purpose of protecting this important organ against bullets and at the same time serve as a case for the dressing-material.

During the Spanish-American war the Surgeon-General issued 270,000 first-aid packages to the troops in Cuba and Porto Rico and the soldiers in the home camps. Two kinds of packages were used. One in a pale red cover contained two antiseptic compresses of sublimated gauze in oiled paper, one antiseptic sublimated cambric bandage, with safety-pin, one triangular Esmarch bandage, with safety-pin. Directions printed on package: "Place one of the compresses on the wound, removing the oiled paper. In cases of large wounds, open the com-

press and cover the whole wound. Then use the triangular bandage, as shown by illustrations on the same." The other package in yellow cover contained the same materials and directions, but was different in shape, somewhat larger, narrower, and thicker. All of the first-aid packages which have been described, including those furnished our own army, are too bulky for first-aid dressing in the field. The packages used during the Spanish-American war did excellent service in the field-hospitals, but there is no place in the uniform of the soldier where they would be tolerated for any length of time for the purpose for which they are intended. Longmore made the statement that during the Egyptian campaign the first-aid packages issued to the troops were used for almost everything else except as a dressing for wounds. During my service in Camp Tanner I supplied the Illinois troops with a small first-aid package, and every soldier left the State with one of these packages sewed into the skirt of the uniform on the left side. These packages remained in place, and were often made use of in the treatment of accidental wounds. No definite conclusions have been reached as to the best place for these packages on the person of the soldier. The helmet, knapsack, the cartridge-box, a hollow space in the butt of the gun, the uniform at a place over the heart, and the skirt have all been recommended as the most convenient place for carrying the package during an active compaign. As the officers and non-combatants do not carry a gun, some place in the uniform or the accoutrement must be found where such a package can be carried without inconvenience and without coming in conflict with military regulations. It must be stored in some part of the soldier's outfit which he is not likely to throw away during a forced march or in the heat of battle. The cartridge or sword belt is about the last thing a soldier will part with, and it is for this reason that a number of years ago I made the suggestion to sew the first-aid package in the middle and upon the inner side of the belt. As the modern cartridge belt is made of canvas cloth, no difficulty presents itself in fastening the package by stitching it to its inner surface. Oiled linen cloth or thin leather

would recommend themselves for the outer wrapper. To be worn in this locality, without objection on the part of the soldier or the military authorities, the package must be small. Large packages of any kind will never prove satisfactory as a first-dressing in the field. The first-aid package for use in the field must meet the following requirements:

1. The material it contains for dressing of the wound must be not only aseptic but antiseptic.

2. The antiseptic used must be non-volatile and resistant to chemical changes for a long time.

3. It must contain a fixation-material which will prevent displacement of the dressing after it has been applied.

4. Its size must be such as not to inconvenience the soldier or to prove a source of objection to the military authorities.

5. The dressing employed should not interfere with the free evaporation of the wound-secretion.

As the quantity of dressing-material must be necessarily limited in the dressing of gunshot-wounds behind the fighting line, it is evident that better results will be obtained if it is impregnated with an antiseptic substance than if it is composed simply of sterile material. Perfect asepsis on the battle-field is a happy dream which will probably never be realized. Disinfection of the wound and its immediate vicinity before the application of the dressing under such circumstances is absolutely out of question. Bullet-wounds should never be touched, much less explored, before the first-aid dressing is applied. The necessity for the use of antiseptic dressings in the treatment of recent gunshot-wounds has been shown most conclusively by the ingenious experiments of Bogdan. This investigator showed, by bacteriological experiments, that the skin of soldiers, protected by the regulation clothing, when in active service, contains on an average, to every 5 c.cm., 4429 pathogenic microbes; and he found, by further investigation, that in gunshot-wounds treated by sterile dressing material the microbes increased much more rapidly than under sublimated gauze. He studied the results of twenty-two dressings after twenty-four hours, and found that under the sterile dressing the microbes had increased

in the space mentioned to 780,729, and under the sublimated gauze to 19,668, the relative proportion of increase being 4 : 176 or 1 : 44. These experiments only prove what we would naturally expect, that the increase of microbes is diminished by the employment of antiseptic dressings in the treatment of wounds that can never be regarded as aseptic.

Carbolic acid is volatile and is not adapted for dressings in the field. Corrosive sublimate, the most important antiseptic employed at the present time, is a very fickle chemical substance, prone to decomposition by chemical changes, which destroy its antiseptic properties when incorporated in dry dressing-material. Iodoform has no decided antiseptic properties, and cannot be relied upon in the protection of recent wounds against infection. Salicylic acid has often been proposed from different sources as the most valuable antiseptic for the first-aid dressing. Boric acid is another stable and valuable antiseptic, but cannot be relied upon exclusively as an antiseptic in a small dressing in preventing wound-infection. For years I have relied on a combination of these two antiseptics as an antiseptic powder as an aid in the treatment of recent wounds. The formula used is boric acid, 4 parts; salicylic acid, 1 part. The line of suturing is covered with a layer of the borosalicylic powder deep enough to bury the sutures out of sight before the hygroscopic sterile dressing is applied. The primary wound-secretion dissolves a part of the powder applied, and the resulting antiseptic fluid resembles in its effects very closely Thiersch's solution, which has, for good reasons, become very popular as a safe, non-irritating, and yet efficient antiseptic. Several years ago I recommended the borosalicylic powder in the above proportion as a valuable component part of the first-aid package, and an extensive experience has only served to strengthen my faith in its antiseptic properties. Fixation of the dressing by the triangular or roller-bandage cannot be relied upon in preventing displacement during the transportation of the patient from the field to the hospital. The dressing must be held in place by one or two strips of rubber adhesive plaster, which must constitute an essential component part of all future first-

aid packages. The size of the package must be reduced to a minimum to do away with the most serious objections against its employment in field-service, and this can only be done by selecting only such materials which are essential in a primary dressing for small wounds. All primary dressings for recent gunshot-wounds should be dry, and nothing must be placed in the way of free evaporation of the wound-secretion, hence all impermeable covers outside of the hygroscopic dressing must be abolished. A dry dressing is one of the very best means of preventing wound-infection, and nothing should interfere with the conversion of the wound-secretion and dressing employed in securing a dry crust which hermetically seals the wound. Sterile absorbent cotton is far superior to gauze as a primary dressing for bullet-wounds, as its hygroscopic capacity is much greater, and at the same time it furnishes a more efficient filter for the exclusion from the wound of microbes from without I would suggest the following first-aid package for field use and emergency work: Two pieces of lintin, a form of compressed cotton, 4 inches wide and 16 inches long, sterilized and folded twice lengthwise; a teaspoonful of the borosalicylic powder in a small waxed aseptic envelope; between them a piece of sterile gauze, 44 inches square, with two safety-pins, folded to correspond in size with the lintin compress; all of these articles wrapped in tin-foil; two strips of rubber adhesive plaster. 1 inch wide and 8 inches long, the whole to be sewed in an impermeable canvas or linen cover. In using the package the powder is applied to the wound, when the lintin is used as a compress, held in place by the strips of adhesive plaster and the gauze bandage over it. If two wounds are to be dressed at the same time, as is usually the case in modern warfare, the contents of the package are equally divided and used, which can be done without materially impairing the efficiency of the dressing. The slight hemorrhage in wounds inflicted by the small-calibre bullet will soon saturate a part of the dressing, which by evaporation will soon convert the antiseptic powder and the cotton into a dry antiseptic crust, the very best protection for the wound against infection.

The important question arises: Where and by whom should the first-aid dressing be applied? A number of prominent military surgeons of the present time, among them Longmore, W. Roth, Wein, and Tiroch, are of the opinion that the first duty of the military surgeons when in action consists in concentrating their energies in providing for a speedy removal of the wounded from the firing line to a place of safety. It is their belief that little or nothing can be done in the way of treating wounds until this has been accomplished. Many of the military surgeons have expressed themselves recently as being opposed to the employment of the first-aid package by any one else except medical men. This position will be found untenable during any great war, when the number of wounded would greatly exceed the working capacity of the limited number of surgeons. Additional and equally strong arguments against such limitation of the first-aid dressing behind the firing line are the well-known facts that the sooner a recent wound is properly dressed the greater is the probability of its remaining practically aseptic, and that the simple dressing proposed in this paper can be efficiently applied by any person of average intelligence who can be made to understand and follow the imperative rule never to touch the wound. Every soldier must be taught the danger of hand-contact and the importance of the first-aid dressing and its manner of application. The trained hospital-corps men of the future can be trusted with this part of the field-service. I am confident that the prompt first-aid dressing applied by well-instructed hospital-corps men and litter-bearers will do more in the way of preventing wound-infection than the delayed dressings in skilled hands. The clothing of the patient, if allowed to remain in contact with the wound for any length of time, is a very serious source of infection, probably nearly on a par with hand-contact, and the sooner the wound is protected from it by the first-aid dressing the greater will be the chances of preventing infection. I fully agree with those who are opposed to the removal of clothing from the wounded part in the firing line for the purpose of inspecting and dressing the wound. The wounded must be

removed to a place of safety as promptly as possible. The first-aid dressing can be applied in a few moments without the removal of any of the clothing except the shoes or boots in dressing wounds of the foot or lower part of the leg. In gunshot-wounds of the extremities the seam of the trousers can be ripped open sufficiently to expose the wound, the underclothing can be cut to the requisite extent to expose the wound or wounds sufficiently for the application of the first-aid dressing. The dressing is fixed in place with the strips of adhesive plaster, and the retaining bandage should be applied not under but over the clothing. In dressing wounds of the chest, abdomen, and pelvis the dressing and bandage are applied in a similar manner. In gunshot-fractures of the extremities an extemporized fixation-dressing of the simplest kind completes the first-aid, and prepares the patient properly for transportation to the rear. The value of the first-aid dressing became very apparent during the Cuban and Porto Rican campaigns. One thing that was supplied liberally and timely by the medical department was first-aid dressings, and to this we must attribute largely the speedy healing of most of the gunshot-injuries and the few wound-complications which later required operative interference. In conclusion I would emphazine the following:

1. First-aid packages are indispensable on the battle-field in modern warfare.

2. The first-aid dressing must be sufficiently compact and light to be carried in the skirt of the uniform, or on the inner surface of the cartridge or sword belt, to be of no inconvenience to the soldier or in conflict with military regulations.

3. The Esmarch triangular bandage is of great value in the school of instruction, but in the first-aid package it is inferior to the gauze bandage.

4. The first-aid package must contain in a waxed aseptic envelope an antiseptic powder, such as borosalicylic powder, two sterilized safety-pins wrapped in tin-foil, and between this package and the outside impermeable cover two strips of adhesive plaster one inch wide and eight inches long.

5. The first-aid dressing must be applied as soon as possible after the receipt of the injury, a part of the field-service which can be safely entrusted to competent hospital-corps men.

6. The first-aid dressing, if employed behind the firing line, should be applied without removal of the clothing over the injured part and fastened to the surface of the skin with strips of rubber adhesive plaster, the bandage being applied over and not under the clothing.

7. The first-aid dressing must be dry, and should remain so by dispensing with an impermeable cover over it, so as not to interfere with free evaporation of the wound-secretion.

8. The first-aid dressing should not be disturbed unnecessarily, but any defects should be corrected at the first dressing station.

OBSERVATIONS UPON THE ORGANIZATION AND EQUIPMENT OF MILITARY FIELD HOSPITALS IN THE VOLUNTEER ARMY.

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ORGANIZATION. The question of the establishment of division hospitals in the volunteer army met with lively debate and at times violent opposition early in the Spanish-American war. Regimental commanders, supported to a greater or lesser extent by the regimental surgeons themselves, took very decided ground against sending their sick away from their own organizations. Aside from the paternal interest which the commanding officer was supposed to take in his men, and the desire on the part of the regimental medical officers to gain whatever *éclat* might come to them from the care of members of their own regiment, there was very little that could be said in favor of the plan of establishing a fully equipped hospital-service in connection with the latter, save under exceptional circumstances. When the regimental organization belongs to the cavalry or artillery branch of the service, and is consequently brigaded by itself and attached to a corps, or where battalions or companies of infantry regiments are detached and located at a distance from brigade or division headquarters, it becomes necessary to provide them with a separate hospital outfit. Again, experience teaches that the duties of regimental surgeons are such as to prevent them from giving that attention to the sick in the hospitals which they require. What between attending morning sick-call, the care of those not severely ill, and who require only a few days' detention in quarters, sanitary inspections, and a watchful care of

the health of the enlisted men in the matter of food and other circumstances of their environment, the duties of these medical officers are sufficiently exacting, and are incompatible with the requirements of systematic hospital work.

On the other hand, experience likewise shows that division hospitals, in the case of an army of raw troops, and particularly when it is encamped in a tropical country, soon become cumbersome affairs. This observation possesses still greater force in the case of troops engaged in an active campaign in the enemy's country. Movements are executed more frequently by brigades than by divisions, and in consequence the division hospital can only exceptionally be located centrally with respect to the larger army organization. These considerations impel the conviction, that as against small regimental hospitals on the one hand and top-heavy division hospitals on the other the brigade hospital offers a logical compromise. When the exigencies of the service require that regimental organizations be detached from the brigade a suitable outfit can be provided by detaching for its use one-third of the brigade hospital. This plan of brigade hospitals will meet the main objections urged by regimental commanding officers, inasmuch as their sick and injured are kept more closely in touch with their own organizations. It will permit of the execution of rapid movements, facilitating the packing of supplies and equipment and the mustering of hospital-corps men. It will divide the responsibility incident to the carrying of valuable property on papers, and lessen the harassing duties of commanding officers of hospitals, enabling these to attend to details in connection with their commands in a much more efficient manner than in the case of division hospitals.

The executive offices should consist of a tent section for the commanding officer of the hospital and one for his chief executive officer or adjutant. In addition to these, when the hospital is expected to remain for a sufficiently long time to receive mail, a post-office tent should be provided; a property office, to take charge of the valuables, clothing, etc., of patients, will be found to serve a useful purpose. Finally, the quartermaster and

hospital commissary should be provided with proper quarters. The dispensary should be under the immediate control of the hospital steward selected for that purpose, the importance of this portion of the hospital service being fully recognized, and ample provision made for the careful checking of all prescriptions filled. In connection with the adjutant's tent, provision should be made for the care and oversight of all records relating to the hospital, from which reports of its condition and work are to be made up. These records should be so kept as to render them available for reference at a moment's notice, the supervision and arrangement of the same being placed in charge of a hospital steward or an acting hospital steward selected for the purpose. Daily morning reports should be expected from medical officers in charge of wards, these showing the name and regiment, or other organization, of every patient under their care, as well as the condition of the same.

In the establishment of the executive offices care should be exercised to secure a certain amount of privacy to the commanding officer of the hospital. To this end, two or more hospital tents should be secured for his exclusive use, and these placed as a section of a hospital ward, with an arrangement of the flaps to shut off the front tent from the rear. The front tent should be in charge of the hospital steward and an orderly, with strict orders to exclude all persons except those having business with the commanding officer direct. All others should be referred to the adjutant's tent, which should be so arranged as to be readily accessible. In the same row should be placed the quartermaster's office, the commissary office, the property office, and the post-office.

The hospital wards should consist of those devoted to the care of medical cases and, in addition, a special ward for the care of surgical cases. It will not be found practicable to care for the sick of the different organizations of the brigade or division in tents especially designated for their use, inasmuch as this will render the hospital outfit cumbersome, owing to the unequal numbers furnished by the different organizations. Nor will attempts to classify the patients according to the diseases

from which they are suffering, save to isolate those suffering from contagious diseases, be found successful.

One or more tent-sections devoted to the care of surgical cases, however, should be established, a greater or lesser number of these being provided according to the exigencies of the service. It will always be found, in every field hospital, that there are medical officers of marked surgical ability whose services in connection with this branch of the work may be utilized with advantage.

An operating-tent, or preferably a pavilion, if the stay is to be sufficiently long to warrant this, should be established. If the former, two hospital-tents with a fly between, the one for storage of the operating equipment and the sterilization of instruments and dressings and the other for the operating-tent proper.

In these modern times every effort should be made to secure the results to be obtained from careful autopsical and pathological studies, as well as bacteriological investigations, in military as well as civil life. These departments should be organized early in the campaign, and every possible facility afforded for the proper carrying on of the work. No effort should be spared to cover every possible phase of the progress of a case, both for the scientific interest attached thereto and the full and complete record of the service.

The general cooking department should be placed under the supervision of the commissary officer, who should be held responsible for its proper conduct. Cooks should be enlisted in the hospital corps as such, and extra pay given to these above that allowed at the present time. A diet kitchen with a special cook in charge will be necessary for the preparation of food for patients and convalescents.

The importance of a sanitary and disinfectant department cannot be over-estimated. This department should include in its supervision the proper policing of the grounds, the care of the sinks, the disposition of garbage and refuse from the wards, including the excreta, and, finally, the cleansing and disinfection of bedding, sheets, blankets, and clothing.

Location and Arrangement. In the selection of a site for

the establishment of a hospital, care should be exercised to have this placed as centrally as possible with respect to the brigade or division which it represents. The ideal location would be an open space, sufficiently high to secure drainage, and with a soil adapted to that requirement. Other things being equal, an open space is to be preferred to a wooded area, although in a tropical country an occasional shade tree will be found grateful. The dangers from falling trees in close proximity to hospital wards in sections of the country where tornadoes occur should not be overlooked. The existence of a proper and readily available water-supply will enter into consideration in the selection as well as the avoidance of the vicinity of marshy low lands, swamps, etc.

In the adoption of a site selected for the hospital, and the selection of a plan of arranging its component parts, advantage should be taken of the prevailing winds of the region, and care exercised that odors from sinks, latrines, etc., be not carried to the wards. The area selected should be laid out in a hollow square, if practicable, and the wards so placed as to be capable of extension in any direction upon one side of this square. The wards are to be placed in parallel rows, with sufficient space between to allow of proper policing, and no more. Compactness should be studied in order to occupy as little space as possible, as well as to economize manual labor, since the exigencies of the service may demand that as few men as possible be assigned to the hospital corps. The wards should consist at first of two tent-sections, of two hospital tents each, with a fly between. The tents should be railed, if practicable, and the space covered by the fly reserved for a medicine table, the ward records, and such other appurtenances desirable to exclude from the wards themselves, and yet kept conveniently at hand, such as the milk-supply, delicacies for the sick, etc. The ward cots or beds should be placed in three rows, running parallel with the wards themselves, one adjacent to either wall and one in the centre. The tents should be floored with tongued and grooved flooring, both for comfort in rainy weather and cleanliness as well.

The prevailing contagious diseases in military life are mumps and measles. These should be treated in tents set aside for the purpose and placed in a remote portion of the ground. Separate quarters should be provided for each of these classes of patients, and every precaution taken to prevent spread of these diseases. The occasional development of smallpox renders necessary an isolation tent and still more stringent precautions against spread of infection.

The question of establishing sinks should be the first care of the commanding officer of a hospital, and an early requisition for the necessary detail from the brigade or division commander should be made for the purpose. In selecting the type of latrine or sink, regard must be had to the length of time that the ground will be occupied, the presence or absence of a piped water-supply, the nature of the soil, the rock strata, etc. Great difficulty may be experienced in solving this question. Opportunity was afforded in the three divisions of the Seventh Corps at Jacksonville for testing and comparing the merits of the three systems—viz., the common sink, the method of carrying army excreta in covered tubs, and the water-flush latrines. Without entering into the details, it will suffice to say that the last-named proved to be the most satisfactory and the second the most objectionable. If the stay upon the selected site is to be a long one, due regard must be paid to economy of the space allotted to the sinks if the common variety be adopted. The regulations governing the depth, size, etc., of the excavation, screening, distance from the surface to which it may be filled, etc., must be followed. Lime seems to be the most available and practically the most efficient method of disinfecting the excreta deposited, and the immediate covering of the latter with earth and twice daily covering with lime fulfil the requirements. Where sufficient depth cannot be reached, either on account of rocky formation or surface water, it may become necessary to adopt the plan of removal of the excreta in half-barrels or tubs. Under these circumstances every effort must be made to accomplish disinfection and avoid unnecessary handling by using the tubs at the sinks to receive the deposits,

and to place therein a sufficient quantity of carbolic or sublimate solution each morning upon their return and before being again used. In this manner immediate disinfection is insured, and a carefully fitted, gasket-secured cover will prevent slopping in the transportation. Separate sinks should be assigned to the hospital-corps men, the women nurses, the officers, and the hospital wards. Typhoid stools should, in addition to being received in receptacles in which carbolic solution or sublimate solution has been previously placed, be deposited in separate and shallow excavations, and further disinfected by heat, this being accomplished by building large fires over the site of the deposit.

Garbage should be cremated when practicable. When the exigencies of the service will not permit of the installation of a cremation plant, it should be transported to a distance, and, as accumulations take place, fires built for its destruction.

Kitchen- and mess-tents should be built adjacent to each other, and the most scrupulous cleanliness maintained. In tropical countries the problem of preventing infection of food by flies is an exceedingly troublesome one. When pavilions are available the use of wire-screens to doors and windows may be available; otherwise a plentiful supply of some of the arsenic fly-papers seems to be the next most practical resource.

In the general arrangement of the hospital the method of utilizing the four sides of a hollow square offers great advantages. The executive tents and officers' quarters should occupy one side of the square, and directly opposite, at the further end of the space occupied, the ward tents are placed, so as to enable a full view of these to be obtained from the commanding officer's quarters and offices. The quarters of the hospital-corps men should be placed upon a third side of the square, and opposite these, upon the fourth side, the quarters of the women nurses. Kitchen- and mess-tents should be placed in the angles, and sinks upon adjoining ground in localities indicated by the prevailing winds.

Equipment. The substitution of brown tentage for the white canvas formerly supplied has been found to be extremely satisfactory. The objectionable glare, so trying to the sick, has

been eliminated by this change. When relative permanency of the hospital site is assured, pavilions may be erected, yet this is not as important at it may at first glance appear. Fever patients, at least, seem to be quite as comfortable in tents as in wooden barracks, particularly in tropical climates. With a limited nursing force and police detail, however, the pavilions have some advantages when the question of conservation of energy and cleanliness is considered.

Where transportation facilities will permit, the use of woven-wire cots with folding iron frames will be found to be the most desirable from every stand-point. Cotton mattresses and pillows placed upon them are conducive of comfort, and sheets and pillows are necessary accessories if cleanliness is to be observed. The conventional pair of hospital blankets completes the bedding outfit. With means for transporting these, and an available source of supply, there is no reason why the added advantages of comfortable beds should be dispensed with even under circumstances of active warfare.

Folding ward-tables and camp-stools or chairs, furnished by the department, among the hospital supplies, are simple in their construction and satisfactorily useful for the purposes for which they are intended. The same may be said of the mess-tables, which, again, are utilized for dispensary and for office purposes. These, with the medical department field-desks, furnish an outfit for the executive and administrative offices.

Supplies of medicines constitute an important feature, and an ample supply-table has been the policy of the Surgeon-General's office. In addition, the liberal plan followed of permitting emergency purchases, when this can be done, seems to furnish a ready means of meeting the indications. It is true that conditions will arise in active campaigning when this cannot be done. A careful commanding officer of a hospital will make timely requisitions and endeavor to keep his medicine and surgical chests intact, since these may be transported at short notice, and should be carefully guarded against loss in moving from place to place as well as falling into the hands of the enemy.

In operating in the open air, or what practically amounts to the same thing, chloroform is found to be the preferable anæsthetic. Etherization by the open inhaler is practically impossible, and those opposed to anæsthetization by the closed inhaler, with its carbonic dioxide suffocation, will prefer the use of chloroform. Its availability in military surgery is unquestioned.

In the matter of antiseptics the best results may be obtained with corrosive sublimate, carbolic acid and boric acid, with perhaps iodoform in addition. With heat sterilization for instruments, dressings, and suture materials, and plenty of soap and water, failure to obtain good results is to be attributed to faulty technique rather than to absence of proper materials.

Even if the alleged advantages of pressure sterilizers were well established the increased weight, and hence difficulties of transportation of these, would be a bar to their use in field hospitals. The Arnold sterilizer has given satisfaction, and will probably be retained. Simple rectangular instrument boilers, with small coal-oil lamps, such as are furnished with the sterilizer chest by the department, are highly practicable and comparatively inexpensive.

The general operating case of the Tiemann pattern furnished to the hospitals of the Seventh Corps was found to be of the greatest utility, save in the matter of a sufficient number of hæmostatic forceps. This want was supplied by extra cases of these instruments containing a dozen each. The general operating case was supplemented by eye and ear and urethral and genito-urinary cases. Although nearly all the surgery of the corps was done either by myself or under my direction, I do not remember a single instance in which the want of instruments other than those furnished was felt.

The operating-room furniture was of the simplest character, yet the work was carried on without hinderance on this account. The mess-tables furnished answered for instrument-tables, and the folding ward-tables answered for the granite-ware basins, etc. A simple folding operating-table fulfilled all the requirements of the operative work. With the necessary amount of

sheets and towels properly sterilized and a vigilant operating-room nurse, the careful operator, providing he could be sure of his assistants, need have no fear as to results if he makes good use of what is furnished under the present allowance.

Accumulating experience shows the trustworthiness of catgut as a ligature material; and silk, as it has been for years, will continue to be the standard suture material, in the army at least. The catgut, furnished in hermetically sealed U-shaped glass tubes, immersed in alcohol and sterilized by boiling after sealing, proved entirely adequate to aseptic requirements. Catgut should not be used in the skin as suture material, for the reason that it is not possible to entirely eliminate micro-organisms from this structure by the most vigorous mechanical means justifiable, and the contact of the latter with dead animal tissue as a culture medium leads to a propagation of the micro-organisms and consequent irritation and suppuration. Silk should be employed for sutures in field hospital work, and in addition to sterilization by boiling, it should be immersed before use in sublimate solution, in order to add an antiseptic quality to this material, which is, in its turn, supplied to the slight exudation which occurs along the suture line, thus preventing the latter from becoming a culture medium in a locality where bacterial infection is most apt to take place.

Surgical gauze or cheese cloth has become the universal dressing material the world over, and finds a ready adaptability in army hospital work. Its sterilization is easily accomplished by means of the Arnold sterilizer. Except in emergency cases, under the most extraordinary strain of heavy and exacting operative work, prepared gauze dressing may be substituted by simple steam-heat sterilized gauze with advantage. Under circumstances where proper preparation of the parts is not possible the first-aid package will be found of use.

Basswood veneer, so generally used in civil life, makes a light and portable splint material. Increased thickness may be obtained by placing a number of these together, and long splints may be made by laying the short pieces one upon another in such a manner as to "break-joints" in a lengthwise

direction, binding the whole together as the pieces are placed in position with an ordinary roller-bandage. Proper cotton padding may be incorporated in the bandage, as this proceeds from one end of the splint to the other. With old blanket material and plaster-of-Paris the well-known Bavarian splint and its modifications may be made by one possessing average mechanical ability.

Finally, the commanding officer of a hospital, when campaigning, should guard with jealous care his means of transportation. The amount of wheel and animal facilities needed will vary with the size of the hospital and the exigencies of the service.

Personnel. The administrative and executive officers of a military field hospital should be entirely relieved from the direct care of the sick and wounded, although the commanding officer of the hospital should be held responsible for their proper care. In the organization of the medical department of a volunteer army the staff officers transferred from the medical department of the regular establishment, by virtue of their familiarity with the routine and discipline of military life, are in a position to carry on administrative work with greater facility than are those who are appointed from civil life. On the other hand, the latter, when properly selected, by reason of their larger clinical advantages, and particularly their opportunities for operative work in hospitals, enter upon purely professional duties, with advantage to the service. It would seem, therefore, that it would be best to organize an administrative and executive staff and a purely professional staff as distinct from each other as possible. To this end the commanding officer of a hospital and his adjutant should be selected from the medical officers transferred from the regular establishment, while those entrusted with the direct care of the sick should be taken from civil life and placed under the direction of a medical inspector or director, who should be responsible for the efficiency of the professional attendance upon the sick and wounded, on the part of the professional staff, to the commanding officer of the hospital. It should devolve particularly upon the medical director to visit the patients in the hospital at least twice daily, in company with

the medical officer in charge of the different wards, and to personally acquaint himself with the condition of the occupants of the latter, and to see that proper records are kept, upon which daily reports are to be made to the commanding officer of the hospital by the ward officers through the office of the medical director. The grade and pay of the medical director should be the same as that of the commanding officer, the former to be the ranking officer, however. Neither the medical director nor the professional staff under his direction should be held to any accountability for government property save for the proper care of instruments and medicines entrusted to their keeping for hospital use, and field desks and books of record for office use.

Each ward of the hospital should be in charge of a medical officer in the grade next lower to that of the medical director. Each ward officer should be responsible to the latter for the proper care of the patients in his ward, and should not be detailed for other than those duties concerned in the care of the sick and wounded.

The operative work of the hospital should be done by a specially organized operating staff, the members of which are selected for their skill and experience in this branch. The staff may be organized from the ward officers, under the officer having charge of the surgical ward, who in turn serves as first assistant to the chief of the operating staff. The latter office should be filled by the medical director, who either performs the operations himself or directs the work.

In the further organization of the professional staff, competent ophthalmologists and aurists should be assigned to duty in connection with the work of a large military organization, such, for instance, as a complete division. There would also seem to be reasons for the employment of a division dentist. The two first named should be commissioned officers, as, indeed, should be all medical men attached to the hospital in any capacity, to enable them to command respect from enlisted men.

In thus relieving the administrative and executive officers of the hospital from responsibility for the strictly professional portion of the work, on the one hand, and those of the professional

staff from duties of a purely administrative character, as well as from property responsibility, on the other, it would seem as if the best interests of all concerned would be served and the good of the service greatly enhanced.

The question of the desirability of an organized force of trained women nurses must depend largely upon the service in which the military force in question is engaged. Under circumstances of an active campaign in an enemy's country this is manifestly impracticable. On the other hand, when the army is one of occupation, or under process of organization in a camp of preparation, there can scarcely be two opinions as to the value of trained women nurses in connection with the organization of a military field hospital. Experience in civil life teaches us that male nurses, as a rule, are untrustworthy, and most surgeons will agree with me that, individual for individual, with selected nurses of both sexes entering into the question, the woman nurse is by far to be preferred. When placed under the direction of a chief nurse selected for the purpose no difficulty was encountered, in my experience, in maintaining and enforcing the most rigid discipline and order. On the other hand, there are objections of an almost insurmountable character to their presence when the work becomes more serious and contending armies are brought face to face. No commanding officer will tolerate the presence of women in the army in any capacity when a battle is imminent, and therefore provision must be made for the care of the sick and wounded from the hospital corps contingent. One advantage accruing from the employment of female nurses in a camp of preparation is the training of hospital-corps men in routine ward work. Selecting the best of the latter, it was found that in a short time a comparatively efficient force was available for service.

This was a fortunate outcome of the situation, for the reason that it was found to be next to impossible to enlist male trained nurses directly into the hospital corps under existing regulations. In fact, the entire system of organization of hospital corps as at present carried out in the organization of a volunteer army is capable of great improvement. In the recent war

volunteer organizations from the National Guard were not permitted to avail themselves of already existing trained hospital corps attached to the organization, a much-to-be-regretted omission. The regular army hospital corps proved to be entirely insufficient as to numbers, and as a result details were made from the regiments for the care of the sick and work incidental to the hospital. The selection of these was left to the company commanders, who availed themselves of this opportunity to work off their worthless material. It is believed that great advantages will follow the enlistment of both male and female nurses as a part of the regular establishment, and that these should be in sufficient number to serve as a nucleus in the organization of a hospital corps in time of war, around which may be readily formed a corps made up of details from the regimental hospital-corps men entering the service as such with their respective organizations.

Medical department quartermasters and commissaries need not of necessity be medical men. There is always difficulty in obtaining efficient line officers for this purpose, however, owing to the indisposition of commanding officers of organizations to part with such. It would seem to be a waste of professional knowledge to place trained medical men in such positions, inasmuch as the duties differ in no important particular from those involved in similar details in connection with regimental organizations, and require absolutely no medical knowledge whatever. An improvement upon present methods would be to commission officers for this service direct, just as volunteer officers are now commissioned in the pay and other special departments, these being selected for their trustworthiness and knowledge of accounts and business methods as well as military experience.

THE EFFECTS OF MODERN SMALL-ARM PROJECTILES, AS SHOWN BY THE WOUNDED OF THE FIFTH ARMY CORPS, DURING THE CAMPAIGN RESULTING IN THE CAPTURE OF SANTIAGO DE CUBA.

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To bring my remarks within the limits assigned to me in this discussion, I shall be compelled to attempt little more than the statement of a number of propositions, fortified, perhaps, by a few illustrations; but anything like statistics or elaborate argumentation will not be employed to sustain my contentions. I desire to call attention to the fact that what I shall say is founded on a fairly large personal experience of gunshot-wounds occurring in civil practice, including one in my own person, and the observation and treatment of hundreds of ball injuries received in actual warfare. While I might cite many cases treated by myself or observed in the practice of my colleagues in support of my views, I must ask you to understand that whenever I venture upon a statement it is the result of personal experience acquired during the treatment of hundreds of cases, the direction of operations, or of treatment of many others, and the study of the outcome of the therapeutic efforts of colleagues in the care of hundreds more of wounded men, many of whom subsequently came under my care. One point of vital importance must not be lost sight of—that owing to lack of knowledge, carelessness, or ill-fortune, many cases which remained aseptic for longer or shorter periods became subsequently infected; this fact will unquestionably explain any apparent discrepancies between the statements I shall make and those published by sur-

geons who never heard a bullet whistle or ever dressed a ball-wound recently inflicted by a modern small-bore projectile.

The reports show that about 1400 wounded were cared for at the hospital with which I was connected, for nearly all of the injured in the Fifth Corps who survived for twenty-four hours sooner or later passed through our hands, so that fresh wounds and those of a day to a week or more were observed. When, owing to the transfer of patients, my personal knowledge failed me as to the ultimate result, inquiry among other army surgeons has elicited the necessary information. My present attitude with regard to many questions should have special weight accorded to it, because it is decidedly opposed to that which I formerly believed I was authorized to teach from what past experience had taught me, or experiments, conservatively interpreted, seemed to warrant me in relying upon.

You will pardon me for briefly stating some facts of ballistics, because, although "the laws of ballistics are a difficult and thankless study, a knowledge of them is of inestimable value to the army surgeon," as Delorme says. Failing to apply some well-known laws of physics has led to numerous errors in theory, upon which have been founded equally incorrect practice. The wonderful initial velocity attained by modern small-bore projectiles, which, when arrested, develops such enormous "energy," has completely obscured the fact of the very remarkable energy of the older weapons. Thus, the Mauser develops 89,543 foot pounds muzzle energy, while the Springfield shows 60,333, only one-third less.

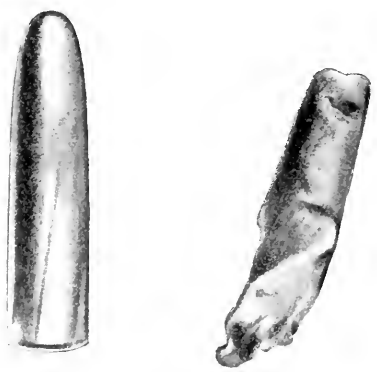
Surprise is often expressed at the trivial, almost incised, character of most flesh-wounds. This should have been anticipated, because, with such immense velocity, if little resistance is experienced, the missile will retain nearly all its "energy," imparting practically none to the tissues. Hence, the devitalization of the walls of the ball-track is reduced to a minimum. Although doubling the velocity of a projectile *quadruples* its energy, as compared with that of another of similar weight moving with half the velocity, it seems too often forgotten that

doubling the mass also *doubles* the "energy," so that when the velocity with which the lighter ball moves approximates that of the heavier ball, the "energy" of the heavier missile is often actually greater than that of the lighter, more rapidly moving projectile. Too many surgical writers have apparently ignored these facts, and then, seeing the tremendous effects produced by modern bullets impinging at short ranges, they have overlooked the retarding effects of the atmosphere upon velocity. Knowing the miles that the modern weapon will send its projectile when sufficient elevation is given, they have rashly concluded that in the mid-ranges the velocity vastly exceeds that attained by the older bullets; hence much greater disruption of tissues and rarity of lodgement was expected than was either observed or should have been anticipated if a few of the laws of physics had been considered. Doubtless ground for these erroneous views was given by the results obtained in dead bodies, in which physical changes in consistence and loss of certain physical qualities of the tissues explain many of the differences between the results obtained by experiment and those observed in actual warfare. The effects of air resistance (hence diminished velocity), with differing rates of actual velocity, in part serves to explain the differences observed with reduced charges for calculated (short) distances, as compared with those following balls driven by service charges at actual distances.

Finally, the convenient phrase, the "energy of a ball means its power to do work which is equivalent to penetration," must not be allowed to mislead. Perforation or deep penetration is not the only means by which the "energy" of a projectile must be measured; its disruptive, tissue-destroying powers are of equal importance. For perforation or deep penetration retention of form is all-important, as is shown by firing first a German-silver jacketed ball into oak across the grain, and then another whose mantle is formed of nickeled steel, the powder charge being the same. Three feet from the muzzle the former will penetrate only 5.3 inches, because the ball *deforms*, but its track shows wide destruction of the wood, while the latter ball will only stop after penetrating 19.5 inches, being *undeformed*,

the track being almost the same size as that of the projectile. In the human body such deformity could only have resulted from an amount of resistance such as would have caused detachment of liquid and solid particles, which would have become secondary missiles, while the remaining "energy" would radiate, as motion, in all directions from the track through the stable portions of the tissues, producing their disruption—*i. e.*, the so-called "explosive effects." I need proceed no further in my attempt to recall other facts of ballistics, since sufficient for my present purposes has been, or shortly will be, detailed.

FIG. 1.



A B

A. Undeformed ball passing sideways through both thighs during life.
B. Deformed core without jacket, removed during life.

A moment's reflection upon the curve described by the trajectory of a modern ball, the much greater length of one diameter, and that many of the wounds are received at from 800 to 1000 yards, must convince you that deflection is quite possible, because of the decided angle at which the ball impinges upon the elastic tense skin, muscles, and fasciæ, or dense bone, the latter presenting planes often inclined at a sharp angle to the line of flight of the missile. If a bullet can be turned sideways by striking the soft parts at an angle, it is a mechanical certainty that further deflection by bone will prove a comparatively easy matter. I have seen a number of wounds made by pro-

jectiles which entered sideways—*i. e.*, with the longest axis at a right angle to the line of their flight, producing a "key-hole" opening.

Impressed with the enormous "initial velocity" of the modern small-bore projectile, sufficient allowance has not been made for the comparatively small "remaining velocity" at 800 to 1000 or 1200 yards, at which distances so many wounds were received. Calculations show that these velocities closely approximate those attained by the older rifles at the shorter ranges at which deflection was known sometimes to occur. Thus, at 1000 yards a Mauser ball, with an initial velocity of 2285 foot seconds, possesses a "remaining velocity" of under 1000 foot seconds (920 foot seconds), with an "energy" of 14,515 foot pounds, the velocity being about that of a Springfield missile at 300 yards, but whose "energy" at that distance is 34,286 foot pounds. At 1000 yards, although the speed of a Springfield ball is only 680 foot seconds, the "energy" is 16,507 foot pounds, while at the same distance the Mauser has a "remaining velocity" of 920 foot seconds, but its "energy" is only 14,515 foot pounds, actually less than that of the Springfield at the same distance. The Mauser retains a velocity of 730 foot seconds at 1500 yards, giving an "energy" of 9139 foot pounds, while the Springfield projectile, with a "remaining velocity" of but 520 foot seconds, develops an "energy" of 9653 foot pounds; these results are due to the more than doubled mass of the bullet and the approximation in the velocity of the two missiles.[1]

[1] These calculations are made by Bashfort's tables and formulæ, and, while not absolutely accurate, the same error being common to all the results, they are sufficiently correct for all practical purposes; indeed, no other method is available, the British War Office relying upon the methods I have employed.

	SPRINGFIELD.	MAUSER.	KRAG.
Muzzle velocity . . .	1300 ft. s.	2285 ft. s.	2000 ft. s.
Velocity at 300 yards .	680 "	1660 "	1390 "
" 600 " .	830 "	1210 "	1020 "
" 1000 " .	680 "	920 "	800 "
" 1500 " .	520 "	730 "	620 "
Muzzle energy . . .	60,333.00 ft. lbs.	89,543.00 ft. lbs.	62,800.00 ft. lbs.
Energy at 300 yards .	34,286.28 "	47,258.54 "	30,333.97 "
" 600 " . .	24,593.73 "	25,109.31 "	16,334.28 "
" 1000 " . .	16,507.68 "	14,515.95 "	10,048.00 "
" 1500 " . .	9,653.28 "	9,139.23 "	6,035.08 "

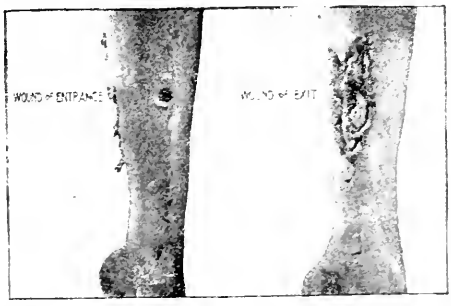
No contention is made that deflection is common or to be expected at short ranges, only that at the distances at which many wounds are received, when the result of the impact of modern military rifle-balls, this is not only possible, but does occur, and more commonly than is taught. Still, further, upon purely scientific principles, readily capable of demonstration, this result could have been foreseen. At short ranges, with the enormous "energy" developed by modern small-arm projectiles, the reverse obtains, but, as proved by the calculation just submitted for your consideration (see foot-note), the loss of "energy" at 1000 to 1500 yards is such as to determine occasional deflection when assisted by favoring circumstances. Although not common, I certainly saw a number of wounds where further deflection occurred after the entrance of the ball, but the weapon from which the missile was fired was certainly far beyond its point-blank range, claimed to be about 600 yards, although I have not yet secured exact data as to this "point-blank" range.

Despite all theory and experiment, a large percentage of the small-bore projectiles, which, in no proper sense of the term, were "spent," did lodge, the Spanish surgeons noting the same of our own Krag-Jorgensen balls. Some surgeons believe that as high as twenty-five per cent. lodged, but this is an exaggerated estimate, the actual number being probably between ten and fifteen per cent. The explanation of this surprising fact was variously sought in the supposed deteriorating effects of the climate on the nitro-powders, but Capt. Charles A. Worden, U. S. A., found that some of the captured ammunition would drive a Mauser ball nine inches further into pine wood than our own Krag balls would penetrate when propelled by fresh powder. Loss of velocity was assumed to have been produced by contact with innumerable twigs and blades of grass during the flight of the bullet, and possibly this was a factor. Still, if you take my calculations as to the retardation of velocity effected by atmospheric resistance, even to a projectile moving with an initial rate of over 1500 miles an hour, it will be seen that the "energy"—*i. e.*, the power to do work, which, in the case of a

bullet, means penetration of tissue—must soon be reduced to a point often incompatible with perforation of the part if bone be met with, because one-half of the remaining velocity, squared, multiplied by the mass of the ball, equals the "energy," and this has been shown to be only about one-sixth of its initial "energy" at 1000 yards, and but little more than one-ninth at 1500 yards.

The majority of the erroneous statements made concerning modern small-bore projectiles have resulted from either ignorance or neglect of some of the facts I have mentioned, combined with the assumption that the dead tissues of a cadaver will react to the application of physical forces, as living tissues will. This is a palpable mistake, because their physical conditions are altered from liquids to solids, as the liquid fat of the medulla and cellular tissue, which becomes changed into a soft solid mass by loss of the body heat.

FIG. 2.



Experimental (explosive effects) at 200 yards.

A due consideration of the foregoing data will also explain why "explosive" effects were so slightly marked, none of the "appalling destruction" (Fig. 2) promised us being noticed, because at the ranges most of the wounds were received, the "remaining velocity" was insufficient to impart sufficient motion to the detached particles of fluids and solids to convert them into "secondary missiles." I need hardly prove to you

that neither the "compressed air" nor "hydraulic theories" explain the "explosive effects" of bullets. Practically identical results are secured when a bullet is fired through a leaden vessel filled with water, entirely open at the top, and one completely closed. Moreover, the point of exit of the ball is exactly *opposite* that of entrance, which would be impossible if the wide-spread rending of the vessel were caused by hydraulic pressure. The instantaneous arrest or sudden retardation of the extreme velocity results in the imparting of the enormous "energy" possessed by the ball to any detached liquid, soft or hard particles of the tissues, these becoming "secondary missiles," while the force radiates in all directions from the ball-track through the non-detached portions of the tissues. It will thus be seen that if two balls, possessing the same "energy," strike the same bone, one passing through the cancellous articular end and the other the dense shaft, the former should do little harm outside its own track, while the other should show "explosive effects" in a degree proportioned to the "energy" possessed by the ball and the resistance met with; and this is precisely what is seen in practice. Yet some surgeons talk as if all wounds inflicted by bullets possessing the same velocity are to be expected to show the same results, totally ignoring the question of "resistance."

Demosthen's dictum that "explosive effects" always result when the cranium is struck at any range up to 1400 metres, is a mistake. Tangental, penetrating, and perforating wounds were all observed, and, so long as asepsis was maintained, did well. I was astonished at the small amount of damage, comparatively speaking, and am convinced that nearly every head wound inflicted at ordinary ranges which did not involve centres essential to life would have recovered if asepsis had been secured and maintained, as was done in some cases.

The term "conservatism," as applied to the treatment of head injuries, requires explanation. In some cases only antiseptic occlusion was employed; where lodgment occurred, this plan was adopted after loose fragments had been removed, but no search was made for the ball; when fracture had occurred

without lodgement of the ball, bone fragments were removed or elevated, the wound irrigated and drainage afforded.

From my preceding statements it must be clear that flesh wounds were always of a trivial nature, unless the ball became deformed by striking some extraneous object, or when stripping its mantle, as it sometimes did (Fig. 1, B). This immunity enjoyed by the flesh wounds caused by Mauser and Krag balls resulted, first, from the slight amount of contusion caused by the rapidly moving ball; second, the aseptic condition of the ball, and, third, the rarity of the carriage of fragments of clothing into the wound, as was not uncommonly done by the 43-calibre Remington, brass-mantled balls. If maintained aseptic, the majority of flesh wounds healed almost as if they had been incised wounds, not uncommonly cicatrizing under the primary field dressing made with the "first-aid package."

Contusions or slight wounds of the great vessels, leading to so-called "traumatic aneurisms," or aseptic or septic sloughing of the vessels many days after the receipt of the wound, were far from uncommon. Thus, I saw one wounded subclavian where the patient survived over three weeks, to finally succumb to hemorrhage during an attempt to ligate the vessel, which was torn for a long distance. I also know of another dying on the table some weeks after being wounded, during an attempt to secure the same vessel. I tied the common femoral for wound and assisted a colleague in securing another, days after the receipt of the injury. I tied one radial for secondary hemorrhage and ordered the tying of an ulnar for ball injury several days after their division, and was compelled to amputate an arm after failing to secure a bleeding brachial in an apparently aseptic wound, two weeks after the man had been shot. Other cases might be added, but these will suffice to show that such injuries are possible.

Largely because all important vessels which were wounded did not give rise to immediate death from hemorrhage, conjoined with the less severe character of the head, thoracic, and abdominal injuries than was anticipated, the mortality on the field was much lower than was expected, about one-fifth of those

struck perishing on the field. Some of the saving of life was doubtless due to the prompt aid given the wounded by the surgeons, who rendered aid under fire, as was shown by the recommendation of sixteen surgeons for brevet rank for "meritorious attention to the wounded under fire."

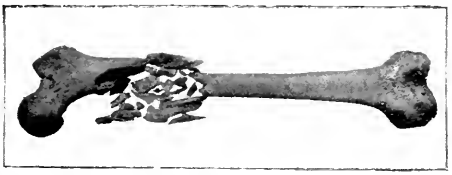
The "first-aid packages" with modern antiseptic precautions were doubtless the chief causes of the small mortality among those wounded, whose injuries were not of themselves necessarily fatal on the field, or within a few hours after their receipt. Unfortunately, from ignorance, carelessness, or defiance of scientific facts as guides to treatment, a number of wounds became infected later, which would otherwise have continued to progress as favorably as they had been doing up to the time of their infection. Even in these cases, a resort to prompt and energetic antisepsis favorably modified the septic processes, and minimized the evils resulting from the infection. The evils of delay in the application of the contents of the "first-aid package" was demonstrated to me in at least two instances by undressing a bullet wound swarming with maggots. Careful inquiry developed the fact that no dressing of any kind had been obtainable for many hours—in one instance nearly twelve hours. If flies could, from without, deposit their eggs in a wound, the ubiquitous pyogenic organisms already present in or upon the patient's skin immediately surrounding the traumatism could still more readily find lodgement therein, unless immediately inhibited by contact with an efficient germicide.

If I am not greatly mistaken, it was not until July 3d that we began to receive "tagged" patients, and it was about the same time that I succeeded in enforcing this regulation in the operating tent at Siboney, in order to lessen the almost hopeless task of handling so many wounded, and to reduce the risk of infection from unnecessary dressings. Unless a patient was judiciously "tagged" when admitted to the hospital, a dressing was necessary to determine the character of the injury. This dressing often proved uncalled for, as demonstrated by the conditions found, and as some were slack as to their antisepsis —difficult at best to attain—a certain number of aseptic wounds

became infected which would otherwise have remained uncontaminated.

The greatest advance in military surgery on the battlefield in recent times is the "first-aid" packet, and the greatest boon conferred on the wounded soldier has been asepsis and antisepsis, because, in the majority of instances rendering his injuries so painless and their complication so slight, that even anesthetics no longer occupy the chief place as a blessing to the wounded, because comparatively rarely needed.

FIG. 3.



Injury by steel jacketed ball at about 1300 yards.

As has been already demonstrated, the "explosive effects" of modern balls at the distance at which most must strike in an actual engagement, will not produce such destruction of bone as often to demand amputation, if asepsis can be secured; hence, removal of limbs for extensive fracturing of the long bones was almost unknown. Indeed, I have seen perforation of a tibia without loss of continuity, notching of the condyloid ridge of the humerus with not even a fissure of the shaft, while other bones were merely guttered. Exploration with extraction of splinters was sometimes done, but antiseptic occlusion was the rule, and was followed by the best results just so long as infection was avoided. When this occurred, the patient was somewhat worse off than if the free drainage secured by exploration with removal of fragments had been obtained. Joint wounds were likewise usually successfully handled by antiseptic occlusion, with such fixation as was available. According to the official report, "more than a score of gunshot wounds of the knee-joint were thus treated with the happiest results."

In a recent article I have seen an implied reflection cast upon the work of some of the surgeons at Siboney, because of the lack of, or comparatively rare use of fixation for the majority of wounds of the extremities. Indeed, it was plainly said that plaster of Paris had not been used as it should have been. We certainly neither had the materials nor time enough to attend to more than the most imperative duty, which was to render and maintain the wounds aseptic and disinfect the septic ones. Later, attempts were made with the utterly inadequate materials at our disposal to immobilize the parts.

Certainly some of us knew quite as well as our critics what ought to be done, but we only did what we could, and did not attempt the impossible, as those who kept out of the way of bullets and hard work thought we should have done. The worst cases were splinted, the milder were not. To antisepsis, in its widest sense, was due the great difference in the secondary mortality among the wounded, which, without this safeguard, would have differed little, if at all, from that observed during

FIG. 4.

Wound of entrance of about 660 yards; perforation of cancellous bone with but little fissuring (from unpublished German work).

the Civil War. Antiseptic occlusion also proved the best treatment for most of the thoracic, abdominal, and, as just said, articular injuries. The confidently prophesied violent hemorrhage from the small vessels of the lung parenchyma did not occur in any cases seen by me. The amount of bleeding into the chest cavity never required primary intervention for its arrest, and, I am informed by others, rarely required operation

later, even then, aspiration usually proving amply sufficient, because infection had been avoided.

All perforating ball wounds of the abdomen operated upon, I am informed, perished, while a number I saw recovered without intervention, antiseptic occlusion being relied upon. The Spanish surgeons reported similar results after undoubted intestinal perforations. I am convinced that it is rarely possible to secure reliable aseptic facilities on the part of patient, surgeon, and attendants, *soon enough* after a general engagement to obtain the advantages of an abdominal section before peritoneal infection has started in consequence of wounds of the hollow viscera. Wounds of the liver and kidneys did not seem to give rise to dangerous infection in the small number treated. If section cannot be done before peritoneal infection has become well established, both civil and military surgeons have long believed that poor as are the chances of recovery, they are lessened rather than increased by a section. This was the attitude I assumed twelve years ago when reading a paper on gunshot wounds of the abdomen before this body, and my experience in Cuba simply confirms me in my original opinion. An operation which adds nothing material to the patient's risks when performed early, in a well-equipped civil hospital, by an expert in abdominal surgery, or after a skirmish even in a field hospital, where the services of an expert can often be secured, will too often determine the death of some patients who might have recovered—as they have in the past by the unaided efforts of nature—when a section is made in a hurry by inexpert, dirty hands. One thoracic wound, several of us believed must have involved the heart, recovered. So far as I can ascertain no formal excisions of joints were done, although atypical resections were once or twice made for shoulder-joint injuries when the humerus had been badly shattered; at the time I questioned the propriety of these procedures, and I do not think I should have consented to have performed these operations myself, unless it was clear that the fragments of the humeral head were so broken as to deprive them of proper nourishment. Explorations of the ankle-joints and wrist-joints with the removal of

bone-sand and fragments, followed by drainage, were done in a few instances, but when I last saw these cases I was not favorably impressed by their prospects. Do not misunderstand me, I am giving the results of actual observations, and I therefore believe that in all cases where distinct indications do not exist for meddling, the best *primary treatment* for modern ball wounds of joints is antiseptic occlusion, to be followed by antiseptic incision, exploration, removal of infected foreign bodies, fragments of bone, etc., and the maintenance of free drainage, *when the occasion requires*, not merely to meet a theoretical possibility which may never materialize.

DISCUSSION ON THE PAPERS OF DRS. SENN, FEREBEE,* FOWLER, AND NANCREDE.

DR. P. S. CONNER, of Cincinnati.

In the few minutes allotted for discussion it is, of course, impossible to consider with any degree of fairness, papers so admirable, so full of information and of suggestions, as those that have been presented to us this afternoon, covering, as they do, a great field of surgical practice. Dr. Senn spoke of the first-aid package. I think the uniform testimony is that the remarkable results that characterized our surgery in Cuba were due in large measure to the employment of the first-aid package. Imperfect as its application often was, it was so much better than the non-use of it, that the results were absolutely astonishing. When I hear that of the wounded in Cuba only 5 per cent. died, my astonishment is extreme. My memory goes back to the time when the death-rate was very much greater, and, as we all know, it was due chiefly to septic infection, by the prevention of which these favorable results have been secured. Cleanliness was an impossibility, as I understand; only the wounded part could be cleaned, and again and again the clothing could not be changed. I am told that, as a rule, our men came North and reached our Northern ports with the same underclothing and other clothing on that they had when they were shot; yet, notwithstanding this fact, the wounds healed in marvellous proportion. The first-aid package has established its value. It was believed to be valuable before; by many it was known to be valuable; but to the profession at large it was at the beginning of our war a serious question whether it could be employed to any great extent; and, in the second place, if used, whether it was of any particular value. These questions are no longer debatable. The first-aid package is a necessity. We are indebted to Dr. Senn for giving us a brief history of these packages and suggesting certain improvements, which he believes to be of value but which must be tested by further experience. We may say, therefore, so far as the consideration of the first-aid package is concerned, there is no consideration of it; it is a settled fact.

We are greatly indebted to Dr. Ferebee for a delightful description

* Dr. Ferebee's article, unfortunately, received too late for insertion in Transactions. —ED.

of a naval surgeon's life and the conditions under which it is spent. We are indebted to him likewise for a graphic description of the conditions which prevailed during the time the navy was engaged in active work.

One point touched upon by him deserves a moment's consideration. In speaking of the conditions which obtained in Guantanamo, where the marines were engaged for six weeks or longer, he told us that they came out of that short campaign in as good condition practically as they went into it—a most extraordinary contrast to the horrible condition, "pitiable," as one of our officers expressed it, of the Fifth Corps when they came North to Montauk. Why was it that these marines, exposed to the same climatic conditions, with practically the same surroundings so far as any telluric condition was concerned, came out in such good condition, and while the soldiers were in a wretched condition? Perhaps an explanation may be found in the fact that the marines landed with their tents, put them up, and were in a measure protected from the influences of the rains, which were of daily occurrence, as I am informed. In the next place, the amount of trenching they had to do was exceedingly limited. Again, they did not have to be removed, but remained where they were, thoroughly provided with all that was needed. That was not true of our soldiers. They landed without their supplies; they moved forward with practically nothing but their arms, they went into action unprovided with those things which they ought to have had. They had no ambulances to move the wounded; they were attended by a limited number of medical officers; they were occupied in fighting and in trenching practically all the time. Is it any wonder, then, that they broke down, especially in view of the fact that they were subjected to the poisonous influence of yellow fever germs, which existed in the houses at Siboney, and were allowed to exert their influence? It was the gravest mistake that these houses were not burned ten minutes after the first man landed. A great variety of reasons have been given for the lack of care our soldiers had, the want of medical supplies, the character of the food supplied to them, etc. But, after all is said and done, the sickness was not due to lack of medicine; it was not due to lack of medical men; it was not due to improper food; but the difficulty lay in the atmospheric and telluric conditions that prevailed, as indicated by the fact that after the Fifth Corps went North, when there was every possible provision made for their care, the volunteer regiments that came down suffered just as severely as the Fifth Corps during the first three

weeks of July. Unless men are properly prepared for campaigning in Southern climates, they certainly will suffer. This is one of the lessons we ought to have learned from history, and not have been compelled to learn it from our own experience.

We are all exceedingly obliged to Dr. Nancrede for what he has said as regards the character of the ball, the force with which it passes, and the results of its striking, so different from those which had been experimentally determined upon and thought to be thoroughly well established. Nothing in the history of the Santiago campaign surprises me more than the fact, stated here to-day, that from 15 to 30 per cent. of the bullets lodged, for a lodged bullet was expected to be of extreme rarity in modern military warfare. We have been told of the character of the wounds inflicted by these projectiles, and it is in keeping with what we have heard before. For the reasons given why lodgement occurred in so large a number of cases, we are all, I am sure, greatly obliged, and the facts stated in regard to the rapid loss of bullet-energy are, so far as I know, new ones.

There are very many things that this short war has taught us, though it was scarcely to be regarded as a war when we take into consideration the number of wounded. Fifteen hundred wounded in a war is a very small number, particularly to those who remember that during the Virginia campaign of 1864, every two days through six consecutive weeks, there were more killed and wounded than during the whole Spanish-American conflict.

As regards the Porto Rico reports, I am very sorry Dr. Parkhill is not with us to say something about them. I understand though that there were but forty-nine killed and wounded during that campaign. A few years ago we lost more men than that in a street fight in Cincinnati.

The paper which was presented to us by Dr. Fowler is full of interest, especially in what it suggests with reference to what should be done in the future. The medical organization of the army needs, I won't say a change altogether, but it certainly needs modification in not a few respects. The question of brigade as against division hospitals is hardly, I take it, for us to discuss at any length. With reference to the advisability of establishing division rather than regimental hospitals, the evidence favors the position taken by the essayist, and there are many reasons why more satisfactory results can be procured under either a brigade or division, than under a regimental, system.

As regards nurses, there needs to be an altogether radical change. The nursing force during our late war was extremely defective in very many respects—in character, in efficiency. The great majority of nurses were male, and were of very little value. That matter should be considered, and we, the representative surgeons of America, have a right to say something with regard to what shall be done to protect the wounded at the time they are brought to us, to say nothing of the sick. I am inclined to take exception to one remark made with reference to nurses, and that is that women can never be taken toward the front during a battle, and I doubt it not on my own account, but because I have been assured by those who have been in Cuba that more than one woman nurse did effective work well at the front, and there is no reason why in many instances with a moving force women nurses should not be carried along with the force. There are objections to the presence of women with a moving army; yet it is one of the glories of the American soldier that though there were fifteen or sixteen hundred nurses who attended the sick and wounded in military hospitals. in not a single instance did they complain of any discourtesy shown to them by the men for whom they were caring. The statement of this fact is one of the highest tributes that can be paid to both nurses and soldiers.

As regards the *personnel* of the army, I am sure that this short war has demonstrated the necessity of having a body of trained surgeons and assistant surgeons who are thoroughly competent to take charge of the duties that devolve upon them. The great majority of medical officers that went out during our recent war were admirable practitioners, but they have much to learn as respects military matters, and because of want of knowledge of such matters much trouble arose. If the recommendation of the essayist should be carried out, and the administrative work be taken from them, and they be instructed only to care for the sick and wounded, one difficulty would disappear, perhaps though only to give place to another. No man should be allowed to prescribe and care for the sick and wounded of our army who has not passed some sort of a fair military examination. There were no examinations of the medical men of the army during the late war, so far as I know, and no examinations of contract doctors until the month of November, when practically the work was all over. This condition should be corrected.

We will profit very much from the reading of these papers when we come to consider the facts that have been presented and the conclu-

sions deduced therefrom. I desire to express my thanks to the essayists for the papers they have presented, and I cannot take my seat without expressing my admiration of the bravery and devotion and self-sacrifice of those medical men in Cuba, who, sick and broken down, as other men were, still stood up to their work, having already in time of battle done well their proper work on the fighting line and in the hospitals behind

DR. EDWARD MARTIN, of Philadelphia.

In accepting the evidence as to the value of the occlusion bandage, it is necessary to be careful lest we go to extremes. We contrast the results of the Spanish-American War with those obtained during our Civil War. Dr. Nancrede has explained clearly why it is that many wounds inflicted in the Spanish-American War healed kindly. It is true that many of the wounds were flesh wounds that were inflicted by the Krag and Mauser bullets, and they healed nicely without the application of an occlusion dressing. Furthermore, many of them healed kindly where the dressings had slipped, and although no one can controvert the practical value of these dressings, yet we may attach to them too great a value. If the evidence is universally in favor of the immediate application of these dressings, the first question to consider is as to whether the dressing of itself is sufficient, or whether it can be improved. There are two forms of dressings. The dressing I hold in my hand was the form of dressing carried through Cuba, and the other which I show represents a similar one. These dressings have been described by Dr. Senn. In our experience we have found it very essential to fix properly the deep antiseptic dressing, because this dressing when applied by hospital men or others would slip, particularly the antiseptic part of it. The idea suggested by Dr. Senn of applying strips of adhesive plaster over the dressing is one which will receive the support of every surgeon who served in the army.

A second point is with reference to the antiseptic quality of the deep dressing. So far as the stability of it is concerned, not only tests of actual service confirm this fact, but also bacteriological tests. I had Dr. Patterson make cultures of a number of dressings after they had been carried through the campaign by the soldiers, and I am glad to be able to report as a result of those tests that not only the bichloride compresses wrapped in wax paper, were sterile, but practically all of the contents of the package were likewise sterile. This dressing is wrapped in rubber tissue, which was subsequently sealed, and the

package can be thrown into water and kept there for hours, yet the inside of the dressings will remain dry. This is an important matter, because the soldier usually carries these dressings in his pocket or knapsack, and as they are constantly wet with perspiration they would be likely to become infected unless they had a waterproof covering. Every private should be taught how to apply these dressings properly. The first package I showed you is simply secured by stitches but it is absolutely waterproof.

With reference to hospital organization, it would seem fitting to let it follow the lines of army organization. The army is made up by the joining of many units, each regiment being a unit. It would seem wise to make a brigade hospital possible by the joining of regimental hospitals as a unit, letting each regimental hospital have a complete equipment, so that it might be added to by other regiments forming the brigade division. There are objections to the division hospital.

Dr. Nancrede's paper upon the statistics of missiles and the explanation of lodgement of bullets I consider of great value.

Dr. Albert Vander Veer, of Albany.

I have listened with a great deal of interest to these papers. My experience of nearly four years during the Civil War is still with me. My recollection of early organization of regimental, brigade, and division hospitals brings to my mind the thought of why they were not thought of in this very slight war we have recently passed through. These papers will go down in history something like this: Should we have a war ten, twenty, or thirty years hence, those interested will say, let us go back to the admirable papers that were presented at the meeting of the American Surgical Association, held in Chicago in May, 1899; and what was said there will give us the gist of practical experience that will remain and has remained with us as a profession. I cannot individualize each paper as I would like to do, as time will not permit.

I felt greatly interested in Dr. Fowler's paper, because I believe that he touched upon a point that is so near to the soldier, the executive and the professional duty of the military surgeon. Regiments are organized in time of war and made up by men who know each other. Regimental surgeons are appointed often by the State, and they continue in the service. A fond parent will say to you: "My son is in such and such a regiment; I feel perfectly safe, because Dr. A. or B. is the surgeon of that regiment, and I know he will be properly taken

care of if he is sick or wounded." If we take away from the soldier himself the moral support of knowing that he is to be under his own surgeon and place him under the influence of an entire stranger, you take away that which aids in his recovery when sick or wounded. Yet, on the other hand, it becomes necessary in great armies to organize a brigade or division hospital. After the second year of the Civil War, as I look back now, in the first division of the Second Army Corps, between the time of two battles we had a division hospital established, and the sick were taken care of. We organized either through the senior surgeon or the man who had been selected by the medical director of the division (there being one or two surgeons from each brigade) and the six or eight officers selected in this way from that division constituted the staff division of the hospital. One man, because of his particular executive ability (a point referred to by Dr. Fowler) was placed in charge of the medical supplies, and it was his duty to see that the medical supplies were kept at the maximum. He kept in line with the quartermaster's train, so that supplies could be had at any time. Another man's duty was to select a proper site for a hospital, and he was ever on the alert to do this. It was the duty of another man to look after the diet list, the kitchen, etc., for that particular division of the hospital. In short, each man knew what was to be done, did it, and what was the result? When we began the campaign in the spring of 1863, shortly after the commencement of the battle, we received some nineteen hundred wounded, and so excellent was the organization that we had a division hospital established within a half hour in which the wounded were being cared for.

I was in hopes that Dr. Conner would have elaborated his remarks a little more in regard to the contrast between the men of the navy and of the army. At Santiago the contrast was great. A man who spent much time in the trenches and was subjected to great exposure must realize that it is different from being on board a ship. Men thus exposed, as a natural consequence, came down with fever. Where were the supplies? Where was the organization we had effected thirty years ago? Who can answer that question? There should have been no such condition. As physicians we know something of what soldiers are entitled to. I have said to my friends many times, when speaking of the organization of regiments in the beginning of this war, go out on the corners, take the officers of the National Guard or non-commissioned officers who understand how to treat men; pick up the men who sleep in dry goods boxes, feed them well, pay them promptly, take

care of them when they are wounded, and they will make the best soldiers you can possibly have. But do not neglect them.

Dr. Herbert L. Burrell, of Boston.

The papers that have been presented this afternoon are certainly very instructive. I must differ from my friend, Dr. Vander Veer, who says that thirty years hence, or when the next war comes, the United States Army will turn to the records of this Association. I hope that at that time we shall be ready to meet any exigency. There can be no question but what there is room for improvement in the organization of our army, as its conduct in the late war has shown. The lines in which this improvement should take I have thought out, but the reform cannot be done hastily. The principal cause which largely underlies the suffering that occurred in our late war was the fact that the people of this country would not believe that a war would ever occur, and they would not allow either the medical department or the line department to prepare for war. Repeatedly the medical department of the United States Army has turned to the Congress of the United States and asked for reorganization or for assistance and they were refused. Even up to the time when war was actively commenced a large number of people in this country said it was perfect nonsense, that Spain would not fight, and that all the United States had to do was to make a demonstration and Spain would back down at once, and it was on this account that proper preparations for war had not been made.

Another thing I was in a position to observe, was the fact that line officers did not properly respect the advice of medical officers as it was given to them. Another thing which had much to do with the condition under which the war was conducted was the ignorance of the well-meaning volunteer medical officer, who was not corrected by the regular officers, who were his superiors. The regular officer was just as much to blame for this as the ignorant volunteer medical officer. The regular officer in superior rank frequently did not correct the ignorant volunteer medical officer.

A great deal has been said with reference to red tape. Why, gentlemen, the trouble is that there was not enough of red tape. The men did not understand how to use red tape. Here is a practical suggestion which I beg to submit to the Fellows of the Association for their consideration: that in all our medical colleges there should be a course—if it is necessary, a set of lectures on military surgery—which

should be given students at some time during the fourth year, imparting to them the necessary information, and what they must expect to be brought in contact with in army and navy medical service. It could be made an interesting set of lectures, and I am sure would be of incalculable value to students after they graduate, because these are the men that must be called upon in case of emergency.

I can only present my compliments and express my admiration for the work done by the medical department of the United States Navy. It was very impressive, a thing I shall never forget. I well remember the condition of affairs which existed at Guantanamo, and of the epidemic of diarrhœa of which Dr. Ferebee speaks. Certainly the navy challenged our admiration.

Dr. W. W. Keen, of Philadelphia.

Dr. Burrell has touched upon one point which I think is important, and which was brought to our attention very forcibly in a recent paper before the Association of American Physicians. Not long since the Surgeon-General of the army had Drs. Walker, Shakespeare, and Vaughan as a board to investigate the question of the prevalence of typhoid fever, and as a result of the partial conclusions of the work of this board, a paper was presented to the Association mentioned, by Dr. Vaughan. Those of you who read that paper will remember one fact which struck me more than anything else—namely, that while there were protests on part of medical officers against unhealthy sites, against unhealthy customs, neglect of camp sanitation, and suggestions that this or that should be done; yet the line officers did not appreciate the value of those suggestions nor heed the importance of their protests, and as a result of it camp sanitation was neglected, and that to a large extent was responsible for the spread of typhoid fever. Now, we must remember, that the military surgeon, certainly the surgeon who prevents, is more than a surgeon, and even so in times of war, but still more in times of peace. I remember very well a few years ago, when I had the honor of appointment before the Board of Visitors of the Military Academy at West Point, I brought forward in that board at the time a suggestion to the effect that instruction should be given in military hygiene and camp sanitation to the line officers—not, of course, in all its details and in the administration of it, as would be given to medical officers, but in the general principles, so that they would understand the value of the suggestions made in these matters by the military surgeons. The suggestion has been unheeded

from that time to this, as so many other recommendations of Boards of Visitors have been unheeded. But it seems to me it would be a proper thing for this Association to place itself on record to the effect, that in the opinion of this Association it is desirable that sufficient instruction in the principles of hygiene and camp sanitation should be given at the Military Academy at West Point, and that copies of this resolution should be sent to the President of the United States, the Secretary of War, and both houses of Congress, and also to the Superintendent of the Military Academy; and I would beg, therefore, to move the above as a resolution, and that copies of it be sent accordingly. (Motion carried.)

DR. CONNER. I hope that this resolution will be put in such form that it will ask for the appointment of a professor of military hygiene at West Point, who shall rank with other professors; otherwise his instructions will not receive the attention they ought to receive, and the suggestions will not be acted upon. It is absurd for the 120,000 medical men in the United States to have no power nor influence in the government of this country. I hope such a professor will rank in dignity with the professors of chemistry, geology, etc.

DR. CHARLES B. NANCREDE, of Ann Arbor, Mich.

I would like to say a few words with reference to the medical organization of the army, for fear that I may have been misunderstood by some of the speakers. I do not know what the orders were for the other corps, but in the Second Corps we understood that the directions came from the Surgeon-General, and they were to this effect: that the corps surgeon was to see that each division surgeon organized a division hospital containing 200 beds, which could be subdivided, it being separable into three brigade hospitals. There were to be 800 hospital-corps men to a corps; 200 were to go with each division and 200 were to be held in reserve. Each division surgeon was to have at his disposal the proper number of ambulances and the proper number of wagons for transporting his hospital and the wounded; the corps-men were to be secured and transferred from the line of regiments to the hospital corps. In case of the division being split up into brigades, the corps-men were to be sent with the brigade from which they came. Only one surgeon could remain with a regiment; the other two were to go to the division hospital or brigade hospital. They would go in rotation, so that it was certain

during any prolonged illness or injury that any man of any regiment was sure to be under the care of his own regimental surgeons. If only sick for a short time, this did not make any difference. Everything was to be done by the medical men. The division surgeon was to be in charge with an executive officer in charge of certain duties. There was to be a medical quartermaster, a medical officer in charge of ambulances, a medical officer in charge of the cooking, a medical officer for each ward, and there was to be a medical officer of the day, whose duties are similar to those of the military officer of the day. There was to be a consulting staff, composed of the physicians and surgeons most skilled in each department. Those were the orders I got to organize. I was chief surgeon of the third division of the Second Corps and ranking division surgeon. Those were the orders, and those were the provisions made.

I think much of the trouble arose from lack of time rather than from a want of knowledge of what ought to be done. I got to the camp about a month before I left for Cuba. The other chief surgeons of the division came after I arrived. All transfers from the regiments to the hospital corps had to be made in a few weeks, and we had to get men from all over the country. I sent word to Boston for one man. I had hard work to get men from anywhere. So the difficulty was not in the way of organization, but we simply did not have time to organize. I got everything ready as well as I could, for I was told unofficially that the division was going to Cuba. But at 12 o'clock one night I received orders to leave the next morning at 9, and had to turn everything in pertaining to the hospital except some medical stores. We could not even have a horse, and we were told none below the rank of a general would be allowed to have horses with them. All we could take was what we could carry, and we were told that our luggage would be sent later.

With reference to red tape, if the volunteer surgeon was ignorant, it was his business to acquire knowledge by studying the regulations or by inquiry. The regular army officers in season and out of season tried to teach and inculcate certain things into those who did not care to learn and would not take the trouble, and who openly said it was of no account. They said they would not obey the corps surgeon; but, as a matter of fact, they did when it came to the point. I have yet to see a regular officer of the medical service who did not, to the best of his ability, help out the volunteer surgeons, if they would be assisted. A good many did not want help.

I entirely agree with what has been said relative to the difficulty of getting along with the volunteer line officers. There was never any trouble with the regular army officer. The medical volunteer officers were helped by them. I will give you an illustration of the difficulties we had to encounter. My men were landed in Cuba in a cocoanut swamp, and the next night there were three inches of mud, and there they had to lie. A number of them had what they called hammocks. I went to the commanding officer and said: "General, these men will be incapacitated for service unless they are moved out of this place." He replied: "It cannot be done, sir." "But," I said, "General, they will die; they cannot stand that sort of thing. Can they not have a dry, sunny place to camp?" He said: "My orders were to put them there;" and I continued: "Can't the orders be changed, sir?" I was told in plain language that I had said enough, and that further remarks from me were not desired; that the men would have to stay there, and they did. I again made the same representations, with the same results. Then the Assistant Adjutant-General of the brigade, who was a regular army officer, ascertained the facts; he was horrified at the condition, and I represented things to him as they really were; and again I made some suggestions, and was told that there was no possibility of putting a regiment, much less a whole brigade, in any better place, but that if I chose to go and look for a site I could do so. This I did, and within twenty minutes I found a location sufficiently large to put the whole brigade where it was dry and sunny. In this case it was not a regular medical officer, but a volunteer line gentleman who had seen service in the Civil War, who prevented the medical officer from properly caring for the men I must say, the regular medical officers did all they could, but the volunteer surgeons only did what they chose. A great many of them, I am sorry to say, did not want to be taught, although there were numerous exceptions, I am glad to say. The volunteer surgeons knew more than anybody else; they said so. They did not care anything about red tape. When I explained to them that red tape was simply business methods, they still insisted upon having medical supplies their own way, but not according to regulation, and then complained that their demands were not complied with.

DR. CONNER. I think if Dr. Nancrede will look up the matter he will find that he is mistaken about the Surgeon-General of the army issuing orders with respect to hospital organization. If I remember

rightly, an order was issued about the 22d of May (and I think the No. was 18) from the headquarters of the Army of the United States —not from the Surgeon-General—having been prepared by Dr. Greenleaf.

Dr. Nancrede. The only thing I know I was told by Lieutenant-Colonel Girard that the Surgeon-General had assented to the issue of these orders, which I believe originated with Colonel Girard.

Dr. Burrell. I am glad Dr. Nancrede has spoken as he has. I think I have been a little misunderstood. The regular medical officer did not refuse to *instruct* the volunteer officer. One of the gravest mistakes—and this I saw repeatedly take place—was that the volunteer medical officer deliberately told the regular medical officer that he would not obey orders. That a regular officer should allow an inferior officer to disobey orders is what I criticise. The volunteer medical officers were often "babied"—that is, their faults were overlooked; whereas, they should have been brought up with a "round turn."

Another important point touched upon is that we are dependent upon a volunteer medical service in this country in cases of emergency. What Dr. Nancrede has said is true. Plans to meet an emergency should have been made long before they were, even to the point of selection of surgeons for the army. We have all seen too vividly the disadvantages of a "rush" campaign, without forethought, and we can be caught in exactly the same box in the next five years unless we plan ahead.

Dr. N. B. Carson, of St. Louis.

I think that we, as physicians and surgeons, are ourselves to blame in a great measure. Many of us have entertained the same feeling as the people, that we were safe from war, and that we would not have war, and as a result we went into this campaign in an unprepared condition, and I am afraid that this same condition will catch us in the next war if something is not done—that is, we are subsiding again into that feeling, and we are doing practically nothing. Unless we assert ourselves we will find that when the next war comes we will be just as unprepared as we were at the beginning of this war. Undoubtedly a good deal of the fault lies in the fact that men are taken who are unfit. They know nothing about the discipline of the army, and

they think they know just as much as those men who have had considerable experience, and they do not want to be instructed or taught. I am afraid, unless we assert ourselves in no uncertain terms, and point out to the authorities the absolute necessity of being properly prepared, if a war should come upon us again as suddenly as this one, we shall find ourselves in practically the same condition.

DR. T. F. PREWITT, of St. Louis.

I have been very much interested and instructed by the papers that have been read, and it would seem that we were totally unprepared for this war, and as a consequence the results have been most disastrous. In many respects I think the fault was largely due, as Dr. Carson has suggested, to improper preparation beforehand. It seems to me the same preparations should be undertaken in the medical department that there are in the military department. As is well known, our government is constantly educating men for the military service, and so for the medical department we should have trained men and thoroughly competent men to cope with any of the emergencies that may arise. A man should not necessarily be made an officer any more than a man should be put in command of a regiment because he is a graduate of West Point. Take the average doctor, and what does he know about military surgery? He knows very little about it. In our Civil War a great many doctors occupied high positions who knew absolutely nothing practically about surgery. And so there are a great many men holding medical positions in the army who practically know nothing about the the duties and necessity of obeying the orders of superior officers. Not only this, but the rush is so great for medical men that it is impossible to pick the sort of men that we really need. But the most deplorable thing is that the medical department seems to have no influence. The military officers pay no attention apparently to the suggestions or advice of medical men. Even with reference to the selection of sites for camps they do not pay any attention to the suggestions of physicians, who certainly ought to know something about sanitation. So far as I can understand, therefore, military officers have utterly ignored the advice and suggestions of medical men during the Spanish-American War.

The papers we have heard are admirable; they present an abundance of material which ought to be exceedingly valuable if it is utilized. The question is, Will it be used to advantage? I hope it will. Our medical department undoubtedly needs reorganization. Many of the

things mentioned would not be tolerated had we a standing army, but coming, as it does, from this country, where we have nothing but a volunteer army, many excuses are to be made for our shortcomings. The question arises, Will the government take the necessary measures to avoid these mistakes in the future?

DR. FOWLER (closing the discussion). Just a word, Mr. President, in regard to the organization of military hospitals. Permit me to say that the plan outlined in the verbal orders given to Dr. Nancrede, and which were also conveyed to our division, absolutely broke down under trial in camp preparation, and how much more serious would have been the failure of the plan in actual campaigning can be easily imagined. The whole trouble arises from the contemptible political methods employed by the State authorities in placing incompetent medical men in the volunteer army. As long as this miserable system exists we simply waste our breath and our energies; we humiliate ourselves because of the defeat that certainly awaits us in the attempt to reorganize the medical department of the army.

APPENDICITIS.

By MAURICE H. RICHARDSON, M.D.,
BOSTON.

I. "Should every case be operated upon as soon as the diagnosis of appendicitis is made?"

II. "Should the appendix be removed in every case?"

Summary.

I. Should every case be operated upon as soon as the diagnosis is made?

As a rule, the appendix should be removed if the diagnosis is made in the first hours of the attack.

After the early hours operation is advisable:

1. If the symptoms are severe, and especially if they are increasing in severity.
2. If the symptoms, after a marked improvement, recur.
3. If the symptoms, though moderate, do not improve.

The wisdom of the operation is questionable:

1. In severe cases in which an extensive peritonitis is successfully localized and the patient is improving.
2. In cases which are at a critical stage, and which cannot successfully undergo the slightest shock.

II. Should the appendix be removed in every case?

It should not be removed:

1. In localized abscesses with firm walls.
2. When the patient's strength does not permit prolonged search.

It should be removed whenever the peritoneal cavity is opened, unless the patient's condition forbids.

The appendix should be removed in all cases as soon as the inflammatory process has had time completely to subside—in from two to three months after the attack. In cases simply drained, the scar-tissue should be excised, the appendix removed, and the wound securely sutured.

The present communication I offer with much hesitation, because I can contribute so little that is new to the discussion of appendicitis; yet it may seem perhaps not uninteresting to present this subject in the shape which it has gradually taken in my mind after observing a large number of cases.

The questions for consideration are all surgical: the surgeon should in every case be given the earliest opportunity for deciding them. Appendicitis is a surgical disease; it should be admitted to surgical rather than to medical wards.

From month to month, from year to year, I find that my conclusions with reference to some of these questions change; that they depend for the time upon the point of view from which they are regarded, upon the class of cases met with, upon the results of treatment in my own cases, upon the experience of others; that at times no course of treatment seems too radical, at others, none too conservative. A series of nineteen consecutive deaths after operation in acute appendicitis (such an experience has occurred, it is said) may well suggest the query whether it were not better to abandon a hard-and-fast rule to operate in every case, and to follow rather a policy of discrimination and selection. If it is said that such an unfortunate experience demands more strongly than ever that every case should be operated upon as soon as the diagnosis is made, it should be added, but only when the diagnosis is made early. On the other hand, it is asserted by some physicians that they have had no cases perish under palliative treatment, and hence no operation is ever necessary. Though my experience has never ranged between such extremes of absolute success and absolute failure, whatever my methods of treatment have been, I cannot but admit that a series of severe cases of appendicitis

in which there has been a large mortality after a comparatively early operation, has excited a strong doubt as to the wisdom of intervention in every case. The large percentage of recoveries in severe cases in which, for one reason or another, no operation has been performed, adds to the doubt already excited. When, after a large experience, the surgeon is convinced that in some cases at least the operation adds the last straw, then it seems that possibly it is unwise to obey an invariable rule of procedure—that there may be some other course worth considering.

If all cases recovered after operation, this question would be much simplified. There is a time for operation when practically all patients will recover; but there is also a time when many will die—when an unwise operation or an unwise palliation will be fatal. In many cases the choice of methods will influence, for good or for bad, the result. This, it seems to me, is the important point for discussion. If, in every case of appendicitis, we operate as soon as the diagnosis is made, we may operate at that very time, I contend, when the patient's best chance lies in conservatism.

In the discussion of appendicitis it must be borne in mind that we are speaking of cases which are pictured in words—not cases under common observation at the bedside. What one may call a severe case, another may call a mild one; what one a hopeless, another only a serious case; what one a general peritonitis, another a simple serous exudate. Such a variation in the way of looking at things is the "personal equation" of the observer, and it cannot be estimated in a body of men who see nothing of each others' work. Among colleagues, however, all must admit that the personal equation is an important element, and that the severity of a case varies, when reduced to language, with the man. In speaking, therefore, of types of appendicitis, of illustrative cases, of *severity*, *urgency*, *hopelessness*, and the like, we must bear in mind that, perhaps, we may not be speaking of exactly the same conditions; and that, though we may differ in the discussion of appendicitis here, at the bedside we very likely should be in perfect accord. The

surgeons of the Massachusetts General Hospital, for example, though they may differ, perhaps, among themselves as to questions raised in this discussion as much as the members of this Association, actually at the bedside seldom, if ever, disagree as to the wisdom of operation. Even in the questions presented here for discussion, there is rarely a strong divergence in opinion when it comes to the application of general principles to specific cases.

In the beginning, the operations for the removal of a perforated and gangrenous appendix were attended by such excessive mortality that the question of surgical intervention seemed extremely grave. To open the abdomen and remove such an appendix was to invite almost certain disaster, for it seemed almost impossible to avoid a general peritonitis. The natural result was to insist upon earlier operations. With earlier operations it was seen that the general infections and the mortality diminished, until it has been shown that practically all operations are successful if performed before the infectious process has reached the peritoneum. Such is the conclusion to which I, at least, have been forced by a considerable experience in the removal of such appendices. When the infectious process has reached the peritoneum, however, the prognosis is in many cases better under palliative treatment than under operative. Then, too, there is the secondary consideration that the incision for the operation in the acute stage is such that it is likely to be followed by weakening of the abdominal wall or by hernia.

The interval operation certainly presents advantages which justify, in a certain class of cases, the risk of waiting.

In my experience those acute cases not operated upon have almost invariably recovered, whatever may be said as to the impossibility of predicting their course. A few, it is true, required operation after more or less delay; but nothing was lost by that delay.

I. The question as to operation in all cases as soon as the diagnosis is made, depends upon the period of the disease; for the

diagnosis may have been made on the first, second, or third (or later) days. *Very early* in the disease means in the first twenty-four hours of it —at its very onset, when the symptoms are the most acute, the prognosis most uncertain. If at any time, it is at this time that the rule should be to intervene. With pain, vomiting, tenderness, abdominal rigidity and fever, the gravest crisis may be at hand. If the diagnosis of appendicitis is made now, the prognosis after operation is better than it would be a day or two later, when, perhaps, a general infection would have taken place. But a positive diagnosis at this time cannot always be made: the symptoms of a great variety of acute abdominal lesions begin in precisely the same way. Perforation of the stomach, acute cholecystitis, acute pancreatitis, mesenteric thrombosis and embolism, extravasation from the intestines, acute salpingitis, ovarian tumor with twisted pedicle, rupture of abscesses, acute intestinal obstruction, congenital malformations of the intestine, ruptured extra-uterine pregnancy; in fact, almost all acute abdominal lesions present symptoms that may suggest appendicitis as strongly as anything else; but so do acute intestinal disturbances dependent upon errors in diet—acute gastric and intestinal catarrhs, ptomain poisoning, cholera-morbus—or even lead-colic.

If the question is changed, if we consider those acute abdominal symptoms that demand immediate surgical intervention, then we must admit, giving due weight to the cardinal symptoms of peritoneal infection, that in the great majority of cases an acute lesion attended by pain, vomiting, rigidity, tenderness, fever, and shock belongs in the category of emergencies requiring immediate exploration, whether the diagnosis is made or not.

As a rule, therefore, operation is advisable in those severe cases of acute appendicitis which are attended by the initial symptoms of peritoneal invasion—in other words, those seen in the early hours of the attack, as soon as the diagnosis is made. Furthermore, this exploration is demanded under the conditions of peritoneal infection described above, even if the diagnosis of appendicitis is not made, because these symptoms demand

intervention of themselves, whether an exact diagnosis is made or not.

On the other hand, it seems questionable whether one should open the abdomen at the onset of an appendicitis of mild type, even if the diagnosis seems reasonably clear; first, because the disease is often so mild and its manifestations so trivial, that intervention can be justified only on the ground that a trivial attack is likely to become suddenly severe—an event which, as far as my experience goes, is extremely unlikely. To this category of mild attacks belong the cases in which there is pain without nausea, vomiting, rigidity, or fever—attacks which subside with great rapidity and which call for intervention only when they recur so frequently as to produce disability—appendicular colics rather than true infections. Not that removal of the appendix in such cases is to be regarded as a serious matter—practically all the cases recover—but the lesion is not grave enough to justify even so safe a procedure as abdominal section until repeated recurrences demonstrate invalidism.

Cases might be introduced here to illustrate the difficulties that attend the treatment of acute abdominal lesions—cases which apparently demanded operation, but in which exploration proved unnecessary; cases treated medically that should have been operated upon, and cases justifying intervention that recovered rapidly without it. Yet the cases in which I have performed an unnecessary operation, and those in which I have omitted a necessary one, have been extremely few in about nine hundred cases. The cases in which an unnecessary operation was performed had a fatal ending in one case. No case occurred in which death followed delay excepting those desperate ones, to be considered below, in which the condition was such that the patient did not seem to have the least chance of recovering except by the unaided—shall I say the *unimpeded*—efforts of nature.

Some years ago I made the statement (*Amer. Jour. Med. Sciences*, January, 1894) that the first symptoms of acute appendicitis were due to an extravasation from the appendix—an infection, either gross and rapid, from the sudden giving away of the

appendicular wall, or gradual, from an invasion of the peritoneum by diffusion—the result being a localized or a spreading peritonitis. Later experience has confirmed this view, though I have seen one or two sharp attacks of appendicitis in which there has been so little peri-appendicitis that I have been able immediately to close the wound. Whether the disease is more rapid and more serious in Boston than elsewhere, I cannot say, but in those cases of severe type, beginning violently, there is always a perforation of the appendix or a localized infection. Early intervention in the trivial cases would doubtless show an infection limited to the interior of the appendix, and permitting immediate closure of the wound.

From the above general considerations it seems not unreasonable to conclude that if any rule is to be laid down as to surgical intervention it should be that even in the very beginning of the disease severe cases require operation, because there is always a perforation, a gangrene, or an extra-appendicular infection; mild cases justify it because there is little danger, and because the wound can be closed. The mild cases will recover whether operated upon or not, so that the benefit of operation will apply only to the severe cases. These cases, unfortunately, do not even now always come under observation in the earliest hours. The surgeon often sees the case for the first time on the second, third or fourth day, at a time when, it seems to me, the wisdom of universal intervention must be seriously questioned.

After the first twenty-four hours of an attack operation is advisable if the symptoms are severe, and especially if they are increasing in severity. At this time, if the attack continues in its original severity, it may be concluded almost invariably that an escape of infectious material from the appendix has taken place, and that there is at least a localized peritonitis. Intervention at this time will show a swollen appendix changed in consistence and in color, with patches of local necrosis, or even totally necrotic. The contiguous parts, whether meso-appendix, omentum, cæcum, small intestine or iliac fossa will be covered

by an exudate and adherent to each other by easily separated finely granular adhesions. At this period there are feeble barriers against speedy infection, but all operations necessarily involve the peritoneal cavity. There may be an actual hole in the appendix, even now, through which, varying in amount with the seat of the perforation and with the liquidity of the cæcal contents, intestinal or appendicular contents may be escaping. The appendix may, on the other hand, be perfectly intact, even with severe symptoms, these symptoms depending upon absorption from the mucous membrane of the appendix itself. Such a condition however is, in my experience, extremely rare. Once or twice only have I felt justified in closing the abdomen after the removal of such an appendix.

The peritoneal cavity at the time always contains free fluid—sometimes clear, sometimes turbid, sometimes foul, according to the extent and nature of the infection. This fluid, if sterile, is a most efficient culture medium, and it cannot but be infected in all operations upon the gangrenous or perforated appendix. Notwithstanding this danger the abdomen, as a rule, should be opened even on the second day if the symptoms are severe, and especially if they are increasing in severity, because of the liability of these fluids to become contaminated in spite of spontaneous efforts at localization. Symptoms are severe if pain continues unabated, with fever, right-sided rigidity and tenderness, especially if there is vomiting and distention. The constitutional signs are less important than the local at this stage, for in some infections, even if they are general, the pulse and temperature may be but slightly affected. Indeed, constitutional symptoms greatly outweighing the local should excite the most careful consideration when appendicitis is suspected, for the former may be merely the expression of an acute absorption from the gastro-intestinal tract, the local signs being perhaps only a painful colic, affecting for the time the right rather than the left side of the abdomen. On the other hand, pain that has made its way to the region of the appendix, that remains there, that is accompanied by extreme muscular rigidity and tenderness, even without fever, should excite apprehension and raise

the question of intervention. With tumor and with fever these symptoms require operation, unless there is rapid and unmistakable amelioration; they demand it if there is constant vomiting and beginning distention, even if some of the symptoms show signs of improvement.

In doubtful cases an unnecessary operation may be avoided by a blood-count made at this time. A leucocytosis often adds the necessary evidence upon which to decide in favor of operation. According to R. C. Cabot, however, at times a patient is so overwhelmed—his powers of reaction are so feeble—that a blood-count will show no increase in leucocytes. One such case has recently occurred in my practice. A young man whose abdomen was filled with infectious fluids, and who was practically moribund, showed no leucocytosis whatever. This was on the second day of the acute symptoms.

On the whole, one seldom errs by operating in cases of severity at this time. The barriers against spreading infection cannot be relied upon—their existence even cannot be assumed. A serous exudate is at hand ready to receive, multiply and transport micro-organisms to the farthest recesses of the peritoneum.

The symptoms in a severe and fully developed case of appendicitis may include pain, tenderness, rigidity, tumor, distention, constitutional disturbances, vomiting, and constipation. The time at which these symptoms appear may vary considerably. Some occur at the very earliest manifestation of the lesion, and persist; others appear early and subside early. Some are never observed. The symptoms seen at that critical period in which so many perish—the third, fourth and fifth days—require careful consideration. What are they, and what weight shall we give them? No one symptom establishes the diagnosis, though several alone may suggest it. They need not all be severe to demand operation, and some may even be wanting. As I have observed them, all are important; but some have more significance than others.

The significance may vary, too, with the stage at which the

symptom appears. Considered in detail from their inception to the full severity of the attack—from the beginning up to and through the third, fourth, and fifth days—the prominent symptoms of appendicitis are as follows:

Pain is the earliest, most urgent, most important, most easily misinterpreted sign. Sharp and intermittent, it suggests and is probably caused by the passage of gas or feces by the inflamed areas about the ileo-cæcal valve; dull and continuous, it indicates the presence and pressure of a localized peritonitis. Pain is to a certain extent the measure in breadth and depth of the infection. After the initial stage, when pain is localized, it means a local infection; when general, a general one. General pain at the onset of appendicitis becomes local as the infection becomes restrained, though the infection may be general while the pain is yet local. As the infection spreads, so does the pain. Sudden, sharp pain after temporary subsidence means a sudden increase in the infected area, and at times is ominous of general peritonitis. If pain is severe and increasing in severity after the early hours, operation is demanded by this symptom alone.

Rigidity becomes right-sided soon after the localization of the infection. Though it may be difficult to estimate a general rigidity, bearing in mind the great tension of abdominal muscles sometimes seen in health, a one-sided rigidity can hardly be mistaken. It is often enough to mask a tumor that under the relaxation of anæsthesia is conspicuous. Rigidity is a symptom of great value in appendicitis. It means but one thing—involuntary protection of underlying structures. It does not follow, however, that the underlying peritoneum has been invaded by micro-organisms, for simple intestinal colics may cause rigidity. Combined with other symptoms, this one possesses a significance of great value. Rigidity with distinctly localized pain strongly suggests appendicitis; with fever, it almost proves it; with tumor, it fully establishes the diagnosis. Rigidity is a symptom rather of onset than of fully established appendicitis, for, as the disease becomes firmly shut off, the tension diminishes. In a few days the right abdomen, in localized

abscess for example, becomes soft, and the outlines of the tumor become easily perceptible.

Rigidity is important in helping to prove an underlying infection. Its prominence and early recognition make variations in its extent easily perceptible. It is therefore a conspicuous sign in estimating the rapidity and extent of spreading infections.

The value of tenderness, too, is great, though this symptom may be the expression of caprice or imagination. Tenderness that is elicited only by deep pressure lends little weight in the consideration of severe symptoms. There are few cases of appendicitis which demand immediate operation when tenderness requires careful examination for its detection. Tenderness in severe cases is almost always great; it is usually exquisite; its manifestations almost ocular. Yet even when unmistakably great, I have seen this symptom disappear so rapidly that I have almost suspected its previous existence. In many chronic cases, and especially in neurasthenics, I have found no peritonitis whatever to account for this tenderness. In the neurotic, the imaginative, the pathophobic, the symptom should be carefully scanned, especially if unassociated with rigidity, tumor or fever. In connection with these signs, it is, however, significant.

On the other hand, the absence of tenderness may be misleading. I have seen serious lesions of the appendix in which neither rigidity, tumor, nor tenderness was prominent, the diagnosis resting chiefly on localized pain, fever, and leucocytosis. It may be asserted, however, that, as a rule, when there is no tenderness there is no rigidity. A tumor without rigidity or tenderness suggests rather a chronic process than an acute one—a lesion that may and should be studied and watched—one that too often proves to be tubercular or malignant.

As an indication of spreading infection, tenderness ranks with pain and rigidity. If these symptoms increase in extent the infection is spreading, when, it is needless to say, immediate intervention is required.

The tumor of appendicitis is perhaps a better guide to treatment than any other one sign, for upon its situation and extent more than upon any one thing depends the probable efficacy of

intervention. With or without operation mild cases of appendicitis will generally recover; cases of general infection will generally die. Localized infection situated in one place will have a small mortality after operation; situated in another, a large. The mortality under operation will depend upon the feasibility of performing that operation without causing a general infection. A tumor to the right or behind the cæcum will permit easy isolation of the operative field; to the left or below, will not. Pelvic and central tumors, especially of large extent, cannot be securely isolated during the manipulations of operation. In separating the adhesions about such tumors it is practically impossible to prevent the spreading of infected fluid over the entire peritoneum. Success after such operations is rather a matter of chance than of expectation—a question rather of the nature of the micro-organisms present than of the manipulative dexterity of the surgeon. In one case the contents of a large abscess may be freed among the small intestines—stirred in among them, as it were—and the peritoneum will take care of the micro-organisms and their products; in another, a single spot of exudate will infect the whole peritoneum. In the one case a mild and perhaps attenuated bacterium will be rapidly overcome, and in the other an active and virulent one will implant and reproduce itself throughout the peritoneum.

The size and consistency of the tumor vary greatly. In the early days the actual tumor is masked by what has been called the cake, which is a combination of tumor, rigidity, and tenderness—the tenderness making the rigidity, and the rigidity the tumor. Under ether a hard cake may dwindle into an insignificant tumor. For this reason it is difficult to estimate the extent of a limited peritonitis in the first few days. I have often been surprised by the rapid disappearance of a large tumor, with the subsidence of tenderness and rigidity. The explanation is doubtless the same as in anæsthesia.

The significance of tumor is great, even if its exact extent is masked. It adds a sign to a suspected appendicitis that is unmistakable. Barring such lesions as intussusception or tuberculosis with tumor at the ileo-cæcal valve, acute abdominal

symptoms attended by tumor in the ordinary situations of the appendix are practically sure to be appendicular in their origin.

Too much significance should not be given to the absence of tumor when other symptoms are severe, for it may be so deeply placed as to escape detection.

Vomiting, distention, constipation, though symptoms possessing, as a rule, grave significance, should not be regarded as necessarily the result of a general infection, for occasionally it will be found that their cause is functional rather than organic; reflex, rather than mechanical. Associated with general pain and tenderness, even if with no other sign, these symptoms mean a general infection. They may by themselves mean nothing but a transitory gastro-intestinal disturbance, and operation undertaken with no confirming signs may lead to disaster.

If, however, the patient is found vomiting after the early hours of a suspected appendicitis, if there is distention and constipation, there is no combination of symptoms more urgent. Intervention must be the rule, even if everything seems unfavorable, for signs that in a local infection point even with uncertainty toward a general one, have a significance that must not be disregarded.

The kind of vomitus and the way in which it is vomited are of importance. Easy and constant regurgitation, for example, is more serious than occasional violent retching; dark colored vomitus more serious than biliary. The value of the symptom of vomiting alone depends somewhat upon idiosyncrasy, as some patients vomit persistently after simple anæsthesia; and others do not vomit even with a fulminating peritonitis.

The importance of constipation depends upon its cause. If no intestinal sounds can be heard, general peritonitis with intestinal stasis is to be feared. This symptom, if caused by mechanical obstruction, is attended by loud gurgling; if by simple inaction, by occasional intestinal sounds. It must be borne in mind that diarrhœa sometimes is present, even in general peritonitis.

The significance of constitutional symptoms cannot be over-

stated in the consideration of operative measures in the early days of appendicitis.

The temperature varies extremely in intensity. It may be normal, it may go to 105°. In a general way low temperature indicates the presence of the colon bacillus; high, that of the streptococcus. I have seen a normal temperature when there was a hopeless general infection; a high one when only the denuded inner layer of the appendix was absorbing. Very high temperatures often subside as quickly as they appear; they are rarely persistent. A continued temperature of 101° to 103°, or a temperature rising by degrees from 100° to 103°, indicates infections, local or general, which require, in the absence of distinct contra-indication, intervention. If they do not demand intervention, they at least demand strong reasons for non-intervention.

Taken by itself, the temperature does not justify laparotomy unless the diagnosis is positive, though it may add the necessary evidence in cases otherwise doubtful.

Temperature without local physical signs; temperature with pain alone, if used as a guide, will too often prove a false one, and may lead the surgeon into error.

The pulse, though of value in connection with the temperature, is an index rather of prognosis than of operative necessity. When high and of poor quality the pulse shows perhaps as much or more than any one sign the depth of the constitutional depression. Such a pulse may be the result of a constitutional absorption from a relatively small area—in which case the signs will be those of a local rather than of a general peritoneal infection. It will, therefore, indicate operation when perhaps the other signs may seem favorable for delay. I have observed time and again the pulse of grave toxæmia attending an absurdly inadequate local lesion—a pulse which, it seemed, would hardly persist through a brief operation, and one which, without doubt, would quickly succumb to the increased absorption of fresh areas unavoidably opened to fresh infections. Such possibilities add significance to the quality of the pulse in localized appendicitis, yet in this instance, as well as in the depressed

pulse of general peritonitis, the only deductions from theory and experience are in favor of instant drainage; I may say, without exception. Even in practically moribund cases, drainage under cocaine seems justifiable.

On the other hand, the most alarming forms of appendicitis may exist without sensible deterioration of pulse. I have, for example, based a diagnosis of mechanical intestinal obstruction upon a normal pulse and temperature, and found on exploration a hopeless general peritonitis. But, it must be remembered, we are giving as closely as possible the weight which is carried by the various symptoms of appendicitis as seen in the third, fourth, and fifth days of the attack, and we must therefore give to the pulse and temperature their usual significance, that of indicating on the whole, in conjunction with the history and local signs, the extent of the infection.

The temperature-curve of three or four days is of value in determining our course, when from other aspects of the case there is reason to dread the results of operation. A fall in pulse and temperature, with subsidence, or even without subsidence, of local signs indicates the possibility of awaiting a more favorable time for intervention; with signs of existing or threatening general infection, a favorable pulse and temperature make less gloomy the prognosis of the early demanded intervention.

Certain other symptoms of appendicitis might be considered, but as they are symptoms rather of general peritonitis they need no especial mention here.

When seen for the first time on the third, fourth, or fifth days, the general trend of the case may be more or less accurately determined. There is either general infection, or there is not; there is either impending disaster, or there is not; there is either marked improvement, or there is not. Is it not fair to question at this time those rules of procedure which require in every case exactly the same line of treatment? May we not at least assume that some of those cases will recover without operation, and that some will die with it, and, admitting human fallibility, may we not by applying a universal rule

turn the scale against the very patient who would have escaped by other methods of treatment? I am firmly convinced that by operating we do at times turn the scale against the patient; and, I admit, that by not operating we may at times withhold his only chance. It is at this critical period, therefore, that intelligent discrimination should be encouraged; that each case should be considered as a case by itself; that no sweeping rule of procedure should be advocated.

After the first forty-eight hours the conditions found at operation differ materially from those of the earlier hours. Necrosis has been fully established, localization has become successful, or infection has become general. The appendix will be found embedded in recent adhesions; contiguous to it, surrounding it, or in some way connected with it will be found a foul-smelling liquid exudate teeming with bacteria. This exudate will vary in its localization between wide limits of peritoneum. It may be far to the right, behind the cæcum; it may be high up, involving liver and kidney; it may fill the pelvis or cover the bladder; it may be buried among small intestines; it may be directly under the skin; it may appear even in the left lower quadrant of the abdomen.

The peritoneal cavity will often be found filled with sterile serum, firmly separated from the infection focus. Too often it will be found already extensively infected. The appendix itself will present all varieties of necrosis from small gray areas to total gangrene. Even at this stage there may be no definite perforation, though generally one will be found. The mesoappendix will itself often show a total necrosis, and the contiguous viscera will be covered with a gray exudate—pseudonecrosis. The probable situation at this time can be determined by the experienced operator, and, I may add, the probable outcome of operation, as well as the probable result of delay.

Unfortunately, in the fatal days of appendicitis—the third, fourth, and fifth day, or even later—the results of operative treatment are still deplorable. Can we not often tide a patient over those critical days to a time when intervention is almost surely successful—when the danger will be that of simple

abscess-drainage or of an intermediate operation? Is it not wise conservatism when the case is severe and of a type that is usually fatal after operation, and when there is, if not improvement or sign of improvement, at least a standstill—is it not wise conservatism to await (always excepting cases of general peritonitis) a more favorable time for intervention? It seems to me that the answer must be affirmative.

Although central localizations of septic fluid about a presumably gangrenous appendix cannot be interfered with in the early days of appendicitis without grave danger of causing a general peritonitis, this danger, grave though it may be, must be deliberately encountered:

1. If the symptoms are becoming more severe, and especially if there is any evidence that a sudden extension has taken place.

2. If the patient is dangerously septic, as shown by pulse, temperature, and circulation.

3. If, though there is no increase in the symptoms, they are still severe.

Surgical intervention in this particularly dangerous class should be postponed, however, if the symptoms show signs of improvement.

This opinion is based upon the large mortality following operation—a mortality due to the unavoidable spreading of infectious material among intestines that cannot be guarded. Intestines cannot be guarded from infection because the limiting adhesions are so fragile that the whole collection is ruptured, if not immediately on opening the abdomen, at least the moment attempts at walling are made. At the very onset, therefore, of operation the whole abdominal cavity cannot escape immediate flooding, in spite of all efforts to prevent this accident. Even later, when it is generally possible to arrange gauze barriers and to separate deliberately the adhesions about the appendix, an inopportune rupture will hazard the success of the operation. Not that such accidents are invariably fatal—they are often harmless; still they cannot but be regarded as the most serious of complications. If it is said

that the peritoneum can be relied upon to take care of large quantities of fluid saturated with living and virulent micro-organisms, my reply is that such an expectation is contrary to common sense and to general experience. Were such powers possessed by the peritoneum, well might we question the necessity for the elaborate details of aseptic surgery. Indeed, if the peritoneum can absorb, without damage to itself or to the system, not drops or particles of poison, but pints or even quarts, it may again be a question how it happens that peritonitis can occur at all.

I cannot but repeat, therefore, what I have said many times before, that the argument against separation of adhesions and the resulting unavoidable contamination carries the greatest weight, and that, dangerous though it may be, delay in cases that are improving is fully justifiable.

The chief argument in favor of operating upon cases of the class that are improving lies in the possibility of sudden rupture. But in carefully watched cases this rare accident can be immediately recognized, and, after all, it is but the spontaneous occurrence of what the operation deliberately causes. The chief advantage is that the extravasation has a short time in which to spread before cleansing can be attempted. A sure contamination must be balanced against a possible one. The chances favor the policy of non-intervention. Furthermore, if symptoms increase in severity, without rupture, the chances from operation grow better instead of worse, because the prevention of infection becomes the easier the more practicable the isolation of the operative field. Moreover, is it not possible that the fluids lose their potency as time goes by? The fluids of the early hours seem to have an activity and virulence which those of the later stages lack. Indeed, fluids long confined are often sterile.

From the above considerations, it seems not unreasonable to conclude that in severe attacks of appendicitis attended by large collections of fluid successfully localized, operation should be postponed for a time, if there are signs of improvement, and more especially if the fluids are localized centrally or in the pelvis.

Another class, by no means small, comprises those cases in which chances are in the balance, the slightest aggressive treatment being sufficient to turn unfavorably the scale. The usual termination of such cases is death, but occasionally recovery takes place, sometimes with operation, sometimes without. The proper treatment in this formidable class is perhaps more a matter of theory than of fact, of speculation than of demonstration. The fatalities in such cases always raise the query whether the other line of treatment would not have been better. Indeed, it is but natural, after failure, for one to wish that some other course had been pursued.

On the whole, however, it seems reasonably clear that, usually, patients are better treated medically when it is reasonably evident that the slightest shock may turn the scale. The principle is the same as that in shock after extreme violence. He would be a rash surgeon who would amputate a limb during profound shock. The best course would be to wait for its subsidence—for a pulse that could at least be felt. So in the profound shock of peritoneal absorption, except that in the latter reaction is less likely to take place. There is perhaps a difference in the significance of shock, according to the period at which it occurs. The initial manifestations of peritoneal contamination are quite another thing from those of fully developed toxæmia, though these two may seem very much alike. The shock, for instance, of invasion is sudden and severe; it affects chiefly the pulse. The temperature may be depressed. In fully developed toxæmia the signs are rather those of approaching death, of cold extremities, lividity, high pulse and high temperature. In the one there is the expectation of reaction; in the other almost certain death.

The difficulties in the way of settling the question of intervention in cases of great severity seem to me extreme, and I offer my opinion with much diffidence. It would be so much easier to apply a hard-and-fast rule. I for one, however, cannot subscribe to an invariable rule of procedure at any stage of appendicitis, and especially at that stage when, from the

above considerations, there is reason to believe that surgical intervention increases the hazard, already great.

II. Should the appendix be removed in every case?

Many of the reasons for not operating in a case of acute appendicitis apply in considering the advisability of removing the appendix in every case that is treated surgically.

It is assumed that at some time or other, in the absence of distinct contraindications, such as unsuitable conditions of age, temperament, general or local disease, and the like, a diseased appendix should be removed. The question is as to the most advantageous time, all things considered.

The best time for the removal of the appendix is in the period of perfect health, or as near that period as is possible. When attacks follow each other frequently at intervals of a few weeks we must take the chances of slight local sepsis, for fear of another attack and possibly a more severe infection. When the abdominal cavity is opened in the course of an acute appendicitis, the appendix should be removed almost invariably, because the manipulations for drainage are little, if any, less dangerous than those for complete appendectomy. The patient's bad condition and failing pulse occasionally forbid removal of the appendix, even when the field is fully exposed.

Removal of the appendix is, in my judgment, contraindicated when there exists an abscess that can be drained through a small incision in the abdominal wall.

There are exceptions to this rule. When the abscess is one-sided, when the strength is good, and when the general peritoneal cavity can be well isolated, the appendix may be sought for and removed. In all such cases Harrington's method of gauze-walling between abscess and abdomen affords abundant protection, even in prolonged manipulations. This method I have found so good that in the last eighty-seven operations simple drainage has been used but four times. True, many of these were not right-sided collections, and the appendix was removed, in spite of the danger, for other reasons, but the gen-

eral trend is toward the removal of the appendix, and cases of simple drainage are becoming more and more infrequent.

Another reason for not searching for the appendix in abscesses of long standing, *i. e.*, with firm walls, is that the appendix is sometimes totally exfoliated. In early cases I have often found a total gangrene, sometimes involving meso-appendix as well as appendix. Such appendices retain their shape; are often firm, though necrotic. In late abscesses the pus evacuated will sometimes float out a slough, with or without concretions. This slough should be carefully examined, for it may be shown to be the appendix.

If it is necessary to break up adhesions for the sake of thorough drainage, removal of the appendix should then, of course, be the rule, but this procedure seems to me totally unjustifiable in the vast majority of cases, for as an almost invariable rule there is but one abscess cavity. Should another develop, a thing which I have seldom seen, that may be drained through the wound of the first, or wherever it may present itself. Some abscesses work through the abdominal wall and point under the skin. Drainage under cocaine is enough to cure such cases. Is not a search for the appendix at such a time absurd? When pus points in the posterior cul-de sac or in the rectum it should be evacuated there, unless it can be drained through the abdominal wall without risk of general infection, and the appendix should be removed after convalescence. In fact, these deeply seated pelvic collections are almost precisely like pelvic abscess from salpingitis, and the reasons for intervention are similar. No form of surgical disease of the abdomen may be more formidable than are the large collections of pus, filling the pelvis and overlain by free coils of small intestine. Operation through the abdomen in the acute stage of these large tubal abscesses has an excessive mortality. Delay with or without vaginal drainage offers two advantages, one that of decreasing virulence in the micro-organism, the other that of decrease in the size of the tube. Occasionally, it is true, intervention cannot be postponed and, risk or no risk, the abdomen must be opened and drained up among and by the

intestinal coils. I cannot but feel oppressed, however, by the gravity of such a condition in salpingitis, and whenever I have been able to await a time more favorable for intervention I have been rewarded by recovery. So in pelvic abscesses of appendicular origin, separation of adhesions and drainage upward for the sake of removing the appendix has an unjustifiable mortality, when by drainage through vagina and rectum a patient almost moribund may be tided along to a time when, through the abdomen, an intelligent method may be employed, by which the appendix may be safely removed and the abscess effectually drained.

That the appendix should not be sought for when the patient's condition is ominous of speedy death is, of course, obvious. If the appendix can be pulled out and removed in seconds, or even in minutes, it may be done, even when the patient's general condition forbids prolonged search. When, however, the appendix cannot be immediately seen or felt, when, for example, broad areas of omentum must be detached, the wound enlarged, the intestines overhauled—when, in a word, search to be successful must be prolonged and extensive, it seems clear that to remove the appendix is bad judgment, a loss of the sense of proportion—a choice of the greater, not the lesser evil.

If in certain acute cases we decide that operation is not best; that during operation in certain other acute cases removal of the appendix is unwise, it remains to consider what remedy, if any, we shall apply to prevent that dreaded recurrence which in so large a proportion of cases must be predicted. Leaving out of the present consideration those mild cases which justify operation perhaps more from disability than from danger of life —although it is impossible, of course, to say that after repeated attacks of a trivial nature a severe one may not ensue—and confining the discussion to those cases in which, after discussion and postponing operation, the patient has made a good recovery, it seems clear to me that in all cases, in the absence of such contraindications as have been enumerated already, a deliberate operation should be undertaken in the period of health.

This opinion is based upon the frequence of recurrence after attacks attended by localized peritonitis and after the drainage of abscesses.

In a large proportion of cases of acute appendicitis a second attack must be expected, even if there has been a localized peritonitis of considerable extent. The probability of recurrence depends upon the anatomical seat of the first lesion, and particularly upon the patency of the opening into the cæcum and its relation to the sunken abscess. For instance, if the original disease started as a perforation near the cæcum, recurrence of severe symptoms are more likely to take place than if the perforation were near the tip. Recurrence depends, too, upon the efficacy of the obliteration following recovery. Though it is impossible to predict in a given case what the real lesion is, abundant experience shows that repeated attacks of severe appendicitis seem to depend upon just such anatomical causes as the foregoing. This is exemplified also in those rather unusual cases in which a sinus persists which extends from a scar into the cæcum. A direct channel thus exists from the cæcum to the surface. Though this sinus is not often large enough to permit the escape of feces, it is generally sufficient to prevent healing. Most fecal fistulæ result from operations upon appendices with localized collections that have broken into the cæcum. No fecal fistulæ as such are likely to depend upon an opening, however large it may be, in the appendix alone, even if the appendix is large and its lumen unimpeded.

Though many operations after recovery from even the severest attacks of appendicitis fail to show material lesions in the appendix, most explorations demonstrate unmistakably the septic nature of the previous process. In many instances cheesy masses will be found about a thickened appendix, the whole buried in firm adhesions. Such evidence of previous inflammation, the impossibility of knowing how persistent the previous sepsis in a given case may be, and consequently whether or not temporary drainage may be necessary—these considerations lead to a postponement of operation for some weeks after subsidence of all signs of the acute attack. Neglect of such a course—a too early

operation after recovery, with closure of the wound without drainage—has led, I believe, to the few disasters that have followed operation in the interval. Such cases really are not operated on in the interval, for they are rather to be classed as subacute. In 244 cases of operation supposed to have been performed in the interval, I have drained for twenty-four to forty-eight hours in a large number, and have lost none. I feel confident, therefore, that closure of the wound adds great risk in conditions of doubtful asepsis. Similar arguments apply to the question of operating after recovery from the simple drainage of an appendicular abscess. A persistent sinus is very suggestive of an opening directly into the appendix. I have removed several appendices that showed this condition. In one case a sinus in the right lumbar region communicated with the tip of an appendix in the iliac fossa, the tip being the only part shut off from the peritoneal cavity. In another instance the sinus opened into the central part of the appendix. Removal of the appendix, sinus, and scar in one piece permitted immediate closure of the wound.

The results of secondary operations after recovery from simple drainage have been among the most brilliant and satisfactory of our interval operations. Every case has recovered, not only from the operation, but from the hernia, if one existed, and from all pains and discomforts. I believe that after drainage, unless there is good reason to believe that the appendix has entirely sloughed away, and even then if there is a hernia, the operation of appendectomy should be completed. Like certain other operations — intracranial neurectomies, for instance, and the removal of brain tumors—at times the safety of the patient demands that the danger be divided between two operations. In such cases the second makes the completed operation. This course, eminently wise under certain conditions, and made imperative by the great risks that at least some of us see attending the so-called completed operation for appendicitis, renders the treatment of large appendicular abscesses particularly gratifying. Such disadvantages as attend the incomplete operation are fully remedied by the completed,

and, what is most to be desired, there is little danger in either. The combined dangers of the operation completed at one sitting vastly outweigh the dangers when performed in two. Finally, by the two-stage operation, hernia and other weaknesses of the abdominal wall are remedied as effectually as is possible.

A glance at the total number of cases of appendicitis which I have personally observed may not be inopportune. The fatal cases should receive particular emphasis, for it is by studying them that we can get nearer the truth than by confining ourselves to the more pleasing list of recoveries. The total number of cases in which the diagnosis of appendicitis was made is something over 900. If each observation were reported, the number of cases would be considerably greater, for many of them were seen at the acute stage, and should be so recorded; these same patients were operated upon at a later date, and have been thus recorded. By appearing in each list the number of observations would thereby be increased, the same patient appearing in separate lists.

The figures are not absolutely correct, because the records have not been exhaustively searched It is safe to say, however, that the fatal cases are all included, because they have been conspicuous. Among them have been placed several deaths as following operations that a more rigid censorship might fairly have excluded from the list of operative deaths. For instance, one case died before operation was begun, another died by his own hand while convalescing, twenty-one died within twenty-four hours; many hardly recovered from the ether; several had simple abdominal incision under cocaine. Though these cases might be eliminated from a discussion of the relative merits of medical and of surgical treatment, and might be used, therefore, to explain or even to reduce my mortality, yet they must be reported not only because they were fatal, but because they all throw some light upon the questions here considered. Twenty-one deaths, for example, within twenty-four hours from the time of operation is an important

experience, and an eloquent argument against the wisdom of operating *in extremis*, though it is a persuasive one in favor of earlier intervention.

The most significant cases in the following table are the acute ones which recovered without operation (158). This group includes those in which operation was deferred because it seemed more dangerous to intervene than to delay. It includes also some which were apparently hopeless and moribund.

Acute cases, operation, recovery	259
Acute cases, operation, death	72
Acute cases, no operation, recovery	158
Acute cases, no operation, death	31
Interval operation, all recovered	238
Chronic cases, declining operation	109
Other diseases simulating appendicitis	37
Total	904
Of 259 operations in acute cases,	
Appendix removed in	154
Abscess drained in	105
But since January, 1898, of 87 operations in acute cases	
Appendix removed in	82
Appendix drained in	5
Total operations, 569.	
Mortality, 12.6 per cent.	
Total acute operations, 331.	
Mortality, 21.7 per cent.	
Total interval operations, 238.	
Mortality, none.	

The statistics of operations for appendicitis are misleading. The mortality after operations in acute cases, as given above, would have been enormously reduced by operating upon all the cases as soon as the diagnosis was made, because practically all the mild cases would have recovered. Not as many, however, as did actually recover after an operation in the period of health; for it is unreasonable to conclude that operations performed under conditions of even slight sepsis are as successful as those under none at all. As for the mortality in a certain class of cases, there is no practical difference between the

different operators. Those cases in which the patient is profoundly septic, with general peritoneal infection, all die—no matter who operates or how. It is idle to contend that such cases can be saved except by a miracle; and those who have a small mortality in acute appendicitis meet a small number of such cases.

The rule that needs to be constantly repeated is the one that calls for the surgeon early in the disease. It cannot be repeated too often. The rule that requires an invariable course of procedure in appendicitis, without regard to the special aspects of the case, to the constitutional peculiarities of the patient, to his surroundings, to the fitness and experience of the operator, is, it seems to me, not one which is justified by a candid consideration of the facts.

DISCUSSION.

DR. JOHN B. DEAVER, of Philadelphia.

The paper of Dr. Richardson has brought out many points on appendicitis about which an active warfare has been waged for some years. It is easy to understand why this controversy has waxed warm, because men of extensive experience have been lined up against each other, taking, in many instances, diametrically opposite views. Upon the surgeon's individual decision at the bedside often depends the life of the patient, and in every case these very points about which we are now talking have to be faced and a decision made. It is, therefore, proper and meet that I should state my views and conclusions, for my experience has been large enough, and I trust well enough digested, to allow me to take my stand against certain matters wherein I do not agree with the reader of the paper.

Should every case be operated on as soon as the diagnosis of appendicitis is made? My answer to this is yes, with two exceptions: (*a*) Acute active general peritonitis; (*b*) collapse.

Should the appendix be removed in every case of appendicitis? My answer here is yes, with the exception of those cases where the bowel forming a part of the abscess wall has undergone necrotic changes rendering the bowel friable and apt to rupture during the necessary manipulation.

Dr. Richardson has most wisely divided his first heading into two classes, those in which the diagnosis has been made in the early hours (and I take it for granted that he means within twenty-four hours), and those in which a diagnosis is made after this period of time has elapsed.

In answer to the first question, I say most emphatically, and I want to be so recorded, that the early hours is the time *par excellence* for operation in this most serious of intra-abdominal affections. First, because practically all cases operated upon at this time get well or, at least, give the lowest mortality, this mortality (of course I refer to the acute cases) increasing with the interval between the onset of the attack and the time of operation. Thus, of 18 cases operated upon within the first twenty-four hours, only 1 died, a mortality of 5.5 per cent. Of 30 acute cases, on the other hand, operated upon within forty-eight hours, 10 died, a mortality of 33.3 per cent. As

far as my experience goes, a careful examination of the statistics of acute cases convinces me that the local pathological changes reach by progressive stages their severest limit within the first forty-eight hours, and after that period the changes are more in the nature of sequelæ following the primary stage of infection. Further comment seems needless. Second, the percentage of cases that have one attack and then remain permanently well and free from other attacks is infinitesimally small. Of 460 of my own cases, 312 of them had more than one attack; in fact it seems to me unjustifiable to offer to a patient the faint hope of any attack of appendiceal inflammation being the last. To do so is to shoulder blindly a responsibility that has no foundation in experience, and is following a course which seems impossible to reconcile with conservative life-saving surgery; therefore, why should we defer the operation for a future attack, the patient being subject in the interval to all the possibilities of the original attack plus the danger from the pathological changes of the intervening subacute or chronic inflammation, or even fresh infection?

Should we operate when the diagnosis is made after the early hours if the symptoms are severe? In answer to this question, I would say that my experience has led me to the belief that symptoms are very unreliable, and are not in proportion to, nor do they indicate, the severity of the pathological processes which are taking place within the belly. Many times have I opened the belly of a patient with a normal temperature, flat belly walls, and a quiet retentive stomach, in whom tenderness on deep pressure was the only sign of persistent trouble, and have found pus, or a gangrenous and perforated appendix.

The surgeon who waits in the case of appendicitis for the appearance of severe symptoms or, worse yet, waits until the symptoms increase in severity for an indication to operate, will have many unnecessary deaths to his credit.

If the symptoms, after marked improvement, recur? A recurrence of symptoms furnishes the same indication for operation that the original symptoms did. I would ask again, Why wait and subject your patient to the same, if not additional, risk? Certainly nothing has been gained by waiting.

I would like to ask Dr. Richardson how many times when he has refused to operate on a case on account of amelioration of symptoms, but subsequently operated, he has said to himself, "If I had this to do over again, I would have operated in the first instance?" Also,

how many times when he has operated in the early hours of the attack has he had reason to regret it?

In severe cases in which an extensive peritonitis is successfully localized and the patient is improving? I should like Dr. Richardson, to explain just what he means by the "successful" localization of an extensive peritonitis, and by what signs and symptoms, as well as with what certainty he is able to diagnose this highly favorable condition? Assuming that in the majority of instances an extensive peritonitis is the result of a more or less active pyogenic process, anyone who is familiar with the effect of pus in the belly cannot help feeling that there is a pressing necessity for its immediate evacuation.

Let us run over hastily the possibilities of pus in the belly. Depending upon the position of the appendix, we may have pylephlebitis, salpingitis and pyosalpinx, ovarian abscess, communication with any of the hollow viscera or with the lungs, bronchi, to say nothing of general sepsis, with a secondary abscess of the kidneys, lungs, and liver.

In cases which are on the edge and which cannot successfully undergo the slightest shock? The two exceptions which I made earlier hold good for this condition, namely, general purulent peritonitis and collapse.

Should the appendix be removed in localized abscess with firm walls? The success in the removal of the appendix in a localized abscess with firm walls depends upon the skill and the technique of the surgeon.

Under these conditions the appendix should be removed (and I am sure that you will all agree with me), the only occasion for a difference of opinion being as to the time of its removal, that is, at the primary operation or at a subsequent operation. If the appendix can be removed at the primary operation without additional risk to the patient, it seems to me that this is the time of election. That it can be done without additional or any risk has been repeatedly demonstrated, and in my own practice I do it in nearly all cases, because in 257 primary removals my death-rate in the past has been 16.7 per cent., and in 13 secondary removals the death-rate was 30.7 per cent.

The reasons for the removal under these conditions are that you do not subject your patients to the danger of an attack of acute appendicitis occurring before the secondary operation. There is less likelihood of fistulæ either fecal or simple. Your patient is cured with one operation instead of two, with the consequent saving of a variable period of invalidism for the patient.

When a patient's strength does not permit a prolonged search? A prolonged search for the appendix should not be necessary. The appendix can hold but one of a few positions. It must be either post-cecal, pointing into the pelvis, toward the spleen; or confined in the ilio-colic or sub-cecal or ilio-cecal fossæ. If the appendix is imbedded in exudate, the exudate itself will indicate the position of the appendix.

I agree with the writer of the paper as to the necessity of the ultimate removal of the appendix, differing from him only in the length of time before the completing operation is performed.

Operation in the early hours does not always bring forth the same measure of success, as the two following cases will illustrate:

Two case operated upon early, the first after twelve hours from onset of attack, had at that time general purulent peritonitis, and the second, operated within six hours from onset, had pus in right iliac fossa.

These cases illustrate the fulminating type of appendicitis, and neither of them gave any special sign or symptom by which a prognosis could be made.

Dr. Christian Fenger, of Chicago.

I wish to indorse Dr. Richardson in nearly all he has said with reference to appendicitis, and consequently I disagree entirely with Dr. Deaver. In my opinion the position taken by Dr. Deaver is altogether too radical. I cannot agree with Dr. Richardson in one point, namely, that in operating on circumscribed cases of appendicitis the appendix should always be removed. In many cases we do better to simply open and drain the circumscribed abscess, leaving the appendix. I do not see why the appendix should be removed in all cases when, according to statistics, only one patient in five manifests symptoms of appendicitis after a previous attack of appendicitis or free opening and evacuation of the localized abscess.

As regards the indication for or against operation in appendicitis, it is commonly stated that when the appendix is perforated it should be removed. In the majority of cases with perforation suppuration is limited and small abscesses disappear by absorption, or by evacuation through the perforated appendix or into the bowel, as is well seen in operating for remittent appendicitis. In other cases absorption or evacuation does not take place, and incision and drainage is demanded.

It is important to differentiate the mild from the severe cases, and advise accordingly. Probably there is no intra-abdominal affection

which causes the surgeon more mental anxiety than appendicitis, when he has to determine when and when not to operate and, furthermore, whether or not the appendix should be removed.

Dr. Francis B. Harrington, of Boston.

I do not operate in every case of acute appendicitis. I think I may say that I am a little more radical than Dr. Richardson. I do not believe there is so much difference of opinion on part of the gentlemen as the discussion thus far would seem to indicate. There are not a great many points on which we differ. Dr. Deaver does not operate on every case. He studies the condition of the patient; if the patient is in collapse, he waits. We all wait.

There are cases of appendicitis in which improvement is more than probable, it is almost certain and in these cases I should delay operation. If there is a reasonable doubt, then I prefer to give the patient the advantage of an operation. In the severe types of the disease I believe that the dangers of waiting are greater than the dangers of operating.

Dr. S. H. Weeks, of Portland, Maine.

I was very much interested in Dr. Richardson's paper, and personally I feel under obligations to him for it. He has made the best presentation of the subject of appendicitis that has been made for some time. I believe the teaching he gives us as to the treatment can be followed safely. Most of us are teachers of surgery, and I believe it is unsafe teaching to instruct students to operate in every case and to remove the appendix in every case. Some two weeks ago I was called in consultation to see a case and found a large abscess. After making an incision down to the transversalis fascia and making a careful search, I could find the point where the abscess wall was adherent to the abdominal wall. I opened into the abscess at that point without opening the general peritoneal cavity. When I found that condition of things I thought it was much safer than it was to open into the abdominal cavity and then remove the appendix. Under the circumstances I did not search for the appendix because the case was of that class which Dr. Richardson has described, there being a large abscess with a firm wall. I put in drainage, not gauze, because gauze does not drain pus well. I inserted drainage-tubes which I think are necessary to drain pus, and I believe that the unfavorable cases which have been frequently reported have resulted from

imperfect drainage by gauze. The gauze becomes distended when introduced for drainage, a pocket is left at the bottom of the abscess which remains and forms the nucleus for another abscess. Dr. Richardson's teaching is safe to give students. I believe that frequently we can find a point where the abscess wall is adherent to the abdominal wall, and in such cases we can simply open and drain the abscess without necessarily opening the general peritoneal cavity.

Dr. Joseph Ransohoff, of Cincinnati.

There is very little difference of opinion in my mind between Dr. Richardson and Dr. Deaver. I think the doctrine advocated by Dr. Deaver would do a great deal of harm if it were followed by most surgeons who operate for appendicitis. It must be remembered that neither Dr. Richardson nor Dr. Deaver does all the operations for appendicitis that are performed in this country. I venture to say that five-sixths of the operations for appendicitis performed in this country are done by the general country practitioner, who has had comparatively little experience in handling the intestines and in dealing with abscess cavities in the abdomen. The danger lies in advocating operative interference in every case of appendicitis. Personally, I would be perfectly willing to have either of the gentlemen operate upon me for appendicitis in the acute stage during the second or third day, but the difficulty lies in operating upon every case as soon as the diagnosis is made, and the general practitioner is apt to do this in consequence of some bad teaching which he has received from some surgeon of large experience.

In regard to removing the appendix in every case, while my experience has not been as extensive as that of many of the Fellows, I feel that there is danger in breaking up adhesions and searching for the appendix in many cases. I now recall only two cases in which I had to search subsequently for the appendix which I had left. I believe in a large number of cases where the abscesses are merely drained and the patients get well, that the appendix has either sloughed away or is bound down by adhesions to such an extent that it is never heard of afterward. I should like to hear the experience of the Fellows on this point.

In regard to the frequency of recurrent attacks of the disease when the appendix remains, I feel sure that the danger from them has been overrated. We must remember that the surgeon's stand-point is different from that of the physician in this regard. Dr. Richardson and

Dr. Deaver have seen many cases in which there was recurrence, but they do not see the hundreds of cases in which recurrence does not take place. Those are the cases they do not see, and for that reason I believe that where we have had an abscess and drained successfully, there is no real reason for letting the primary operation, which has done well, be followed by a secondary one. Possibly if it is done too early, it may not be followed by the same admirable result.

In regard to the existence of fecal fistulæ, we see them occasionally. Those are the cases in which the abscess has continued for a long time, or possibly, as the result of an extensive search for the appendix, damage has been done to the intestinal wall. In one case in which I had a fecal fistula following operation for appendiceal abscess, I felt reasonably sure that the abscess was not responsible for the formation of the fecal fistula, but that it was due to a too extensive search on my part.

Concerning the advisability of operating after frequent attacks, there can be no question. The important point in the whole discussion by such a representative body of surgeons lies in the fact that conservatism ought to be advocated, not so much for the Fellows of this Association as for those men who have not had much experience, who feel from the teaching which they have received that they must operate on every case as soon as the diagnosis is made, and invariably remove the appendix, no matter what the condition may be that is found, or no matter what condition the patient may be in.

Dr. Nicholas Senn, of Chicago.

Uniformity of practice in the treatment of appendicitis will probably never prevail. Each man formulates his own indications and follows his own rule of practice. Any surgeon who follows such a stringent rule, with few exceptions, as advocated by Dr. Deaver to-day, may be a good practitioner, but he would certainly make a poor and dangerous teacher. I do not know how the other Fellows of the Association feel on this subject, but for my own part I always feel weakest in the matter of making an early diagnosis in the first attack. I believe this is the weak point in the surgical profession to-day in the treatment of appendicitis and in formulating safe rules in practice. To illustrate only one point in this regard, I would like to refer to two cases that have come under my observation during the last five months, where it was extremely difficult and, in fact, almost impossible to make a differential diagnosis between perforative appendicitis and perfora-

tive typhoid ulcer. Certainly, at the time the operation was performed, the pathological conditions were such that the trouble might have been mistaken for either one of the affections I have mentioned. The first case I wish to relate was that of my esteemed colleague, the late Professor Hamilton. He had been suffering three weeks from vague febrile disturbance. A positive diagnosis was not made. One evening he was attacked with severe pain in the lower segment of the abdomen, and he was not confined to bed more than two or three days before this occurred. I saw him a few days later and found a distinct swelling in the median line a little below the umbilicus. Fever was slight; the inflammatory process evidently was localizing itself, and there was a question as to the nature of the original cause of the localized peritonitis. The symptoms became so grave as to necessitate a laparotomy, which was performed on the left side of the median line, a large abscess found, and on making an exploration I had no difficulty in detecting a perforation of the intestine large enough to admit my thumb on the mesenteric side of the small intestine. The diagnosis was now perfectly plain. With great difficulty I closed the perforation and flushed, and for five days everything promised well and we entertained hopes of ultimate recovery, when a few days later he died of hemorrhage from the typhoid ulcer. I am sure that, in this case, if the localized product had been found in the right iliac region instead of the left, we would have been certain it was a case of perforative appendicitis.

I operated on a young man in Rush Medical Hospital only a few weeks ago, the case being one of perforative peritonitis caused by appendicitis. I found the patient in collapse, or nearly so, the abdomen immensely distended, and there was no difficulty on physical examination to determine the presence of pus in the lower part of the abdominal cavity. I proceeded at once to perform a laparotomy, on the ground that I had to deal with a case of appendicitis, and operated in the usual way. A large quantity of pus escaped, and a diffuse peritonitis was recognized. I had an idea some time before that it was a case of perforative peritonitis with probable sloughing. In this case I simply drained and flushed. He rallied, contrary to our expectations, something I attributed largely to the incision I made in the enormously distended and paretic intestines and the evacuation of the intestinal contents, and everything seemed to progress favorably for a while. Suddenly the patient grew worse, and died with all the symptoms of

progressive sepsis. A post-mortem examination showed additional abscesses among the coils of intestine and numerous typhoid ulcers

Here are two cases of perforative typhoid ulcer from ambulatory or walking typhoid, closely mimicking perforative peritonitis. I am sure that in neither of these cases would the patients have been benefited by making a search for the supposed disease of the appendix, causing additional danger and the removal of perhaps a healthy organ. I do not wish to insinuate that anything of this kind is to be directed against Dr. Deaver, who certainly stands at the head of the surgical profession of this country, and whose practice is perfectly safe in abdominal work, but I do know from personal knowledge of men who have been guided by the rules he lays down who have repeatedly removed the healthy appendix. A number of such cases have come under my observation with a history of having been operated on for appendicitis, with no relief. I therefore have reason to assume that under a mistaken diagnosis the healthy appendix has been removed without the expected relief. I have not even a suspicion that such a thing has ever been done, either by Dr. Deaver or any Fellow of this Association. However, in our teaching of the treatment of appendicitis to classes of students, we must learn to be cautious, and if we err at all, we should err on the safe side.

Dr. P. S. Conner, of Cincinnati, Ohio.

My experience has been so comparatively limited that I hesitate to say a word upon this subject, but I have long felt, Mr. President, that there are two words that have no place in surgical language—ever and never. That is no safe rule that directs that every case of a certain disease shall be operated on, or that an operation for a certain condition should never be done. There are cases that do well without operation. On the other hand, we have all had cases come under observation, apparently doing well and seemingly on the road to recovery, when suddenly a change has taken place and they have become vastly worse, and death has occurred promptly. I recall the case of a young woman with appendicitis who was in apparently as good condition as one could be with this disease, and yet in four hours from the time I saw her she was dead. These cases make us pause. It is not wise to be governed in our surgical judgment by single cases. It is not wise, on the other hand, to neglect the warning of single cases. I believe if I have made any change in the last few years on this sub-

ject, it is that I have become more radical rather than conservative, and that I see more advantages from the rule of operative interference than I once did. Perhaps if it had been my fortune to have seen many hundreds of cases, as has fallen to the lot of some of our Fellows, I should be as enthusiastic in operating as Dr. Deaver. But I do not think it would be a wise rule to go out from this Association that every case of appendicitis should be operated on as soon as the diagnosis has been made. There have been cases in which grave errors have been made; but who is free from error? I do not think it is wise to interfere surgically in mild cases early showing signs of improvement, even though apparent recovery may be followed by a subsequent attack, which it is not always, by any means. Operating on cases in the interval is practically devoid of danger. I say practically devoid of danger; it would be an error to say that any surgical operation is devoid of danger. In many cases conservatism is to be preferred to radicalism. Personally, I wish to express my extreme pleasure at having heard the able paper that has been presented by Dr. Richardson, and must say that while I do not believe in operating on all cases, I do believe in operating on all suitable cases.

Dr. Dudley P. Allen, of Cleveland, Ohio.

There are one or two points in connection with this subject to which I desire to direct attention. One is with reference to removing the appendix in all cases. I find I remove the appendix in an increasing number of cases, but of those cases of abscess and sloughing of the wall in which I did not remove the appendix there are but three that did not heal themselves. Only one out of a large number of cases gave subsequent trouble. The other point is with reference to fecal fistula following operation for appendicitis. I have seen fecal fistula follow a considerable number of cases, and in only one of all my cases has it persisted, the others having healed of themselves.

Dr. Richard H. Harte, of Philadelphia, Pa.

The remarks made this morning have not been intended for a class of medical students, but for experts in surgery, and what we may say to medical students cannot be said to experts, because the cases differ so much.

In the early operation for appendicitis I cannot see what harm has been done if the appendix has been removed. The perfect man is the man without an appendix. Dr. Senn spoke of two cases in

which he said it was extremely difficult to differentiate between perforative appendicitis and perforative typhoid ulcer. Were those cases any better off by waiting? I think not. They are both dead. Conservatism in appendicitis is a great mistake. My experience has taught me to fully concur in a great measure in the radical rules laid down by Dr. Deaver, and I know my statistics are very much better in those acute cases where the appendix has been removed; and in those cases in which the appendix has not been removed I do not consider the operation has been completed. In nine cases out of ten the appendix can be removed with little risk.

Dr. Allen referred to cases operated on by him in which he left the appendix and the patients have had no further trouble. I have seen a number of cases where the appendix was left, and the disease has recurred and the patients operated again. I wish to go on record as saying emphatically that the operation is not complete except the appendix has been removed, which I think can be done with very little risk of danger.

As to the question of drainage, I wash out the abdominal cavity with hot sterile water every half hour, and keep it up from twenty-four to forty-eight hours. I know I have saved cases from general peritonitis by this mode of treatment, rather than leave in a gauze drain or the old-fashioned piece of wicking sticking out.

Dr. H. H. Mudd, of St. Louis, Mo.

I think all of us who have had much experience in appendicitis can sympathize with Dr. Richardson in the development of the subject, and can realize from his statements the different steps he has taken in making progress in the more exact knowledge that determines the present stand-point. I was particularly gratified when he presented the question, with his doubts of the time for operation or the propriety of operation after the development of the general or local peritonitis—that is, the condition of doubt that came to him as to whether operation was wise at this time, or twelve or twenty-four hours later, or after the process had been distinctly localized and an abscess was forming. It is a difficult thing to determine, so difficult that we must all of us make errors in the determination of time for operative interference. I do not think there is any one who has had much experience with this character of cases but what has a record against himself of some mistakes.

So deceptive are the symptoms of appendicitis in the expression of

the gravity of the case, whether seen early or late, that I have drifted to the conclusion that if I can see the case within twelve or eighteen hours from the beginning of the first attack it is better to operate, whether the symptoms are mild or severe, because we cannot tell in these cases whether the case is going to develop into a condition that is severe or is going to resolve itself into a simple case that disappears in a day or two. This, I believe, is wise in many of those cases where the diagnosis can be made within twelve or twenty-four hours. Yet there are a few cases so distinctly mild in character that I should not propose operation during the attack. Dr. Richardson called our attention to the point that it was very rarely he saw an acute case and operated upon it so early as to find no infection outside of the appendix. That is true, unfortunately for us, yet I think we do find it where we operate within twelve or twenty-four hours in some cases. I recall the case of a young woman who had had a number of obscure abdominal attacks that were unrecognized as appendicitis. She came under my observation at 6 o'clock one evening, having suffered continuously from pain since 12 o'clock of that day. At 12 o'clock at night I operated on the case, the pulse being 120, temperature 104°, pain not severe, and I found an old chronic infiltration about the appendix with a distinct doubling of the appendix, the appendix being tense and firm. On the outside of the appendix there was nothing to indicate any inflammatory action. In the distal portion beyond the bend the appendix was necrotic on its mucous surface. Here we closed the abdomen without any drainage, and the patient made a good recovery.

The difficulty in diagnosis is not always confined to the acute cases. I have seen a great many of these cases through some of my medical confrères in St. Louis, where the diagnosis was obscure, the obscure abdominal conditions having led to complaints of indigestion, of disturbance of the stomach, of pain obscure in its localization, so that it was extremely difficult to make a diagnosis of appendicitis. I have seen such cases under the observation of surgeons and physicians for months in hospitals without being able to make a correct diagnosis.

As to the removal of the appendix in cases of abscess, I think we have all passed through the stage Dr. Richardson has described—that is, we remove the appendix more uniformly now than we did a few years ago. So uniform has that practice become with me, that an experience last winter illustrates it. I had in the hospital a patient with an ugly abscess with gangrenous walls, with an offensive dis-

charge. I opened this large abscess, drained it, and I thought the appendix had probably sloughed and disappeared in a mass of material that was washed out. A fistula followed, and after some months I opened it and found a fistulous opening in the colon. I loosened it, closed it, did not look for the appendix, and the man recovered very nicely. But about the third week the drainage, which had evidently been going on from the diseased appendix into the bowel, or out through the opening, was shut off from the appendix and a tumor formed, and the patient came to see me one day with another tumor about the appendix. I had forgotten that I had not removed the appendix at the primary operation. I looked up the records of the case and found that the appendix had not been removed. I told the man to go to the hospital and I would remove it. He went to another surgeon, and he took it out.

Dr. W. Joseph Hearn, of Philadelphia, Pa.

I do not think there is so much of a disagreement between Dr. Richardson and Dr. Deaver as we would suppose. They believe in opening appendiceal abscesses, as we all do. We take out the appendix whenever we can. When we are talking to students we are more careful and cautious than when we are talking to each other. I do not dare to teach students to remove the appendix in every case, or to operate upon every case as soon as the diagnosis is made. I teach students to open appendiceal abscesses, and never to let a patient die from not simply opening an abscess. We can open the abscess through the belly cavity. I rarely break down the abscess wall when it is firm for the sake of finding the appendix, but if I can find it easily, and I can take it out, I always do so. I never refuse to operate early. If a patient is brought into the hospital at midnight with a well-marked tumor I defer operating until the next day at my class hour. I sometimes do this, although my conscience is not clear. When collapse does not take place, and the abscess does not rupture during the night, I feel happy. I have never yet had such a thing happen to me, but I think it might at any time. I have never had the bad results Dr. Deaver speaks of in opening abscesses after forty-eight hours. As a matter of fact, we do not see some of these cases until three or four days after the attack. Physicians do not call us in time; if they did, we should probably operate at once. At least I should.

I experience great difficulty in making a diagnosis early in the attack, and I feel this is one of my weak points. I do not care to

operate for appendicular colic or a catarrhal condition of the bowels. Those are the cases of so called appendicitis upon which I refuse to operate. On other cases, however, I operate at once; I do not wait twelve hours. You may think I am exaggerating, but I want to say that we rarely lose a case of appendicitis at the Jefferson Hospital. If you are called to see a case of acute septic infection, with loss of peristalsis, such a case dies, as a rule, whether you operate or not. I have operated on cases of that kind. In one case I made an opening on the right and left sides and flushed with a bucketful of normal salt solution, and the patient got well. This patient had general septic infection with loss of peristalsis.

As to perforative appendicitis, I lay much stress on the facial expression where there is not general peritonitis. On two or three occasions I have saved the lives of patients by operating immediately. To wait twenty-four hours in order for nature to throw out an exudate would render the patient beyond operative procedure. After pus forms I do not let the case go any longer than I really can help.

As to the desirability of taking out the appendix, this should always be done, if possible, as it is better to do so than to run the risk of general infection.

DR. B. F. CURTIS, of New York.

When I looked at the programme and read the question, "Should every case be operated on as soon as the diagnosis of appendicitis is made?" the point naturally occurred to me, that we certainly would not operate in every case as soon as the diagnosis is made, particularly if we had made a diagnosis of catarrhal appendicitis, and I take it that it is here that Dr. Richardson and Dr. Deaver stand together, although that fact has not been brought out by either of them. If we could know that an inflammatory lesion exists in the appendix and is about to perforate it, I believe all of us would favor operative interference at once, whether there were peritoneal signs or not. It is difficult to tell whether pus is present in the appendix or outside of it, but if pus be present operation is indicated. The discussion of this question turns on the intermediate cases in which catarrahal inflammation exists Such cases may present many symptoms of suppuration, and yet no pus be present. Shall we operate on such cases or leave them alone? Those are the doubtful cases, not the cases with abscess or with perforating appendicitis. As Dr. Senn has said, the great difficulty is to make a diagnosis in the doubtful cases. I doubt very much if any

surgeon here who is called in by the family physician to see all of his cases of appendicitis would operate on every case. I know that I decline to operate upon many such cases, for I see many patients in this way who are sick for two or three days only. In such cases I am called in by the attending physician, and I find tenderness and some minor signs of appendicitis. A fairly large number of catarrhal cases occur which to my mind are most suitable for medical treatment, and I believe they should be left alone by the surgeon. No surgeon can operate early enough if the signs of infection of the peritoneum are present. Very many cases of relapsing or recurrent appendicitis show an apparently healthy condition of the external coat of the appendix, yet on the inside we find pus, ulcers, or even gangrene confined to the mucus membrane—as shown in the pictures passed about this morning. If we could make an early diagnosis and operate at once on such cases, it would be well, but often the patients present no symptoms, and the diagnosis is impossible.

Dr. N. B. Carson, of St. Louis, Mo.

I agree with the last speaker, that it is not wise to operate on every case of appendicitis, even if we see the patient early and make a diagnosis in the first few hours of the attack. Very many cases get well without operative interference. There are patients who never have a recurrent attack of the disease, and it is the last we see or hear of them. I have seen quite a number of such patients. I think if we adopt the plan of operating on every case as soon as the diagnosis is made, our mortality would be greater than if we waited. Within the last two weeks four cases of appendicitis have come under my observation which, if operated on immediately, would be in their graves to-day. One case developed an abscess of the lung, it being tubercular in character. When I saw the patient the indications were decidedly against operation. Operative interference was therefore postponed; the patient progressed favorably for several days, then began to get worse, and we thought it was best to operate. I simply opened the abscess and drained, making no attempt to remove the appendix. The patient I speak of I examined thoroughly and carefully at the time, and found no serious trouble in the lungs. The abscess finally discharged, from which the patient died. Unfortunately the case was in the country, and I was unable to get any of the pus for the purpose of examination to determine whether the case was tuberculous or not. In these recent cases, by attempting to remove the appendix and

breaking up adhesions, we open a larger field for absorption, and we are more likely to have increased sepsis with death of the patient.

Again, in such cases as have been described by Dr. Richardson on the blackboard, the abscess should be opened and no attempt made to remove the appendix or break up adhesions. If we suspect several abscesses or a general peritonitis, we should make a median incision; if we find that we made a mistake, and that we have a single abscess walled off from the general cavity, we can close our cut and open the abscess. Two cases have come under my observation, one of which Dr. Prewitt will recall having seen with me. In that case we suspected general peritonitis; we made a median incision, and found we were mistaken. We had a limited abscess surrounding the appendix, we closed up the first opening, and then made an incision over the abscess, emptied its contents and drained, and the patient made a good recovery.

In the other case I made a similar mistake, and finding it out I immediately closed the median incision, opened the abscess and drained. I think that is a safer plan than the one advocated by Dr. Harrington, of opening into the peritoneal cavity in all cases and depending upon our efforts in damming it off. We sometimes fail, and the result is bad. From the experience I have had in the two cases cited I should say it is a great deal safer, after you open the abdominal cavity and fail to find any abscesses or infection outside, to simply open the abscess and drain. In the many cases in which I have opened the abscess cavity and drained, not removing the appendix, in but one has there been a fecal fistula.

Dr. Richardson. If I had read my paper in full it would have answered many of the points that have been raised by Dr. Deaver and others in the discussion. If he had carefully looked over the statistics in the article of mine referred to by him he would have seen that the mortality after draining abscesses is practically *nil.* Dr. Deaver mentioned his mortality as compared with mine in these cases. I would like to say that I do not think statistics of mortality amount to much. Those who have had much experience with the acute cases of appendicitis can tell beforehand whether they are going to die or not. I think you will appreciate the points I have made when the paper is published and you have it at your leisure. I maintain that not only do cases die because they are not operated upon, but many of them die because they are dealt with surgically. If some of us fail, we have not

done our duty by withholding operation. If we advise against operative interference and the patient dies, we feel more or less guilty. I have said nothing of cases that recover without operation. The other day, last Saturday, one of our most experienced operators in Boston opened the abdomen of a patient at the hospital and tried to find the appendix. Several of us were watching him, but it could not be found easily. The patient's pulse was 160, and it was evident he was going to die soon, and the operation was abandoned by a good surgeon.

With reference to fecal fistula following operation for appendicitis, it constitutes an interesting aspect of this question. In the beginning some surgeons will resect the intestine for gangrene when it is nothing but a pseudo-necrosis. I never saw a fecal fistula in which the opening was not in the cæcum or in the small intestine. I have seen sinuses time and again. (Here Dr. Richardson went to the blackboard and demonstrated by diagrams how sinuses sometimes persist after the removal of the appendix. He also showed the manner in which fecal fistula occurs after operating on cases for appendicitis.)

ON SOME CONDITIONS OF HEALING BY FIRST INTENTION, WITH SPECIAL REFERENCE TO DISINFECTION OF HANDS.

BY THEODORE KOCHER, M.D.,
OF BERNE, SWITZERLAND.

IF we are to decide whether we are on the right way with our aseptic preparations to warrant a healing by first intention or not, we cannot answer that question simply by bacteriological demonstration of presence or absence of bacteria alone, but we must be guided by our clinical results. We know that even in cases of healing *per primam intentionem sans phrase*, where we withdraw a drainage-tube after twenty-four hours and get our wound absolutely closed within two days, we may find bacteria by dropping some of the bloody liquid of the first day in sterilized bouillon and keeping it at 37° for twenty-four hours.

It seems perfectly sure that we can get a primary union, that is to say, either a healing of our wounds without any secretion whatever, when it was possible to close a wound throughout, or with a serous bloody discharge, diminishing from the very moment of the operation, when a drainage-tube had to be put in a cavity, even in cases where some bacteria have been introduced. Accordingly, it seems necessary to give the first clinical results of a method of asepsis which we think worth recommending for general use.

Therefore, when I was greatly honored with the invitation of your President and Secretary, Dr. Keen and Dr. Burrell, to present an introductory paper for a discussion on disinfection of hands at the annual meeting of the American Surgical Association in Chicago, I asked my assistant and son, Dr. Albert Kocher, to gather the whole material of our operative

cases during the winter session from October 1, 1898, to last of February, 1899, and to put all cases where we operated on not already infected cases, down in a chronological order, with the indication of date, disease, operation, and of the material we used for ligatures and sutures, of the use of gloves, of drainage-tubes, the final result, and date of dismissal of the patient. Certainly this last date does not mean the moment of healing of the wound, which had always taken place days before, but it gives still a better idea of the form of primary reunion.

As is seen by these statistics, we have had during five months 339 aseptic operations, of whom 5 died—1.4 per cent. No one of these has died from infection going out from the wound. The first case was a case of acute fatty degeneration of the liver, to be attributed to the chloroform, after excision of goitre[1] in Graves's disease three days after operation; the wound entirely healed by first intention. The second case was a death by pneumonia four days after the operation of too long-standing incarcerated hernia, as they often occur without any local complication. The third case of death was an excision of malignant goitre, having gone much too far, as we had to perform resection of trachea; the patient died of pneumonia. The fourth and fifth cases of death were two patients with carcinoma pylori in a state of great exhaustion, The one on whom resection was performed died after two days from pneumonia, the other after exploratory incision three weeks afterward from exhaustion.

As to the 334 cases left for judging the value of our aseptic preparations, we have had small abscesses in 8 cases, with healing by *secundam intentionem*, very quickly as a rule. So we see that except in 2.3 per cent. of cases there has been always absolute primary healing of our wounds.

Of the 8 cases where this was not the case 3 had to be excluded from the question of failure of the aseptic measures, because there was another source of infection: In Case 255,

[1] I have to explain this case, which was quite exceptional, as I never in the last years used any anæsthetic in these cases except cocaine: but the patient, who had agreed with that manner of performing the operation, behaved in such an extraordinary, unruly way that we were obliged to give chloroform, though perfectly aware of the great danger.

with excision of the appendix vermiformis, an abscess was opened during the operation containing bacillus pyocyaneus, and the same bacterium developed in an abscess of the abdominal wall ten days afterward, as we had been imprudent enough to close the wound without introducing a drainage-tube. Case 297 was one of incarcerated crural hernia, where an abscess with staphylococcus aureus developed after eight days. But this case, except of giving the possibility of infection through the altered intestinal wall as all strangulated hernia of long standing, infected her wound herself by putting her hand, which had not been sufficiently fastened (fixed), in the wound during the operation. Case 323 was an excision of suffocating goitre in a child three weeks old, when internal treatment had failed to give relief. It was found that in detaching the comparatively large and adherent growth from the œsophagus a fine hole was made in this latter organ, so that some discharge existed for several days.

Five cases are left where the infection was introduced in the wound from outside—1.4 per cent. of our cases. Two of these patients were cases of secondary infection during after-treatment when the wounds were dressed. In Case 212 a large hæmatoma had formed by secondary bleeding after excision of goitre, which had to be opened by the assistant dresser, after which an abscess formed with staphylococcus aureus two weeks after the operation. Case 196 concerns a case of double genu valgum. One side healed *per primam;* the other side, after-bleeding gave rise to the formation of a hæmatoma, which was opened by the assistant dresser, and gave rise to a small abscess after two weeks.

In excluding these two cases as having nothing to do with the introduction of germs *during the operation,* three cases are left where abscesses formed in wounds which were expected to heal by first intention, that is to say, *in* 0.8 *per cent. of our cases an infection took place during the operation.* It is very interesting to see what was the cause of these three infections. In two of them *catgut* was exceptionally used instead of silk, and in both cases secondary abscess formed, growing out from the deeper

layer of sutures, while the skin-wound had healed perfectly well with silk sutures. In one of these cases (208) the abscess formed after three weeks only; such late formation is the rule in cases of infected ligatures. Certainly this is not mere accident, as we used catgut only in 10 of all our cases, so that with catgut we have got secondary abscess in 20 per cent., with silk or other material only in 0.3 per cent., that is to say, in one case out of 229. In one of the cases where catgut infection took place no gloves were used during the operation.

Now as to the only case where we can recognize an infection during the operation executed with our ordinary means and aseptic preparations, it was such a slight case that it is a question if it be worth while to speak of an infection. It is Case 138, where we operated for Graves's disease with ligature of superior thyroid artery on both sides. The one side healed by first intention throughout, on the other very little secretion kept on for ten days, when the wound was perfectly healed; there was no formation of abscess, but staphylococcus aureus was found in the bloody secretion. As one side was healed with regular aseptic course, quite an accidental infection must have taken place on the other side.

So I think I may be justified in saying, that *practically, with my usual method of asepsis during* 225 *operations, I have had one case of formation of abscess or suppuration of a wound during the whole winter.* Is now this result to be attributed to the introduction of *gloves* during this period? I am sure this is not the case, by the simple reason that we have had the same good results before when we did not use the gloves.[1] But at any rate, we may state, that the results are no worse, on the contrary, as perfect as we may wish them, since we introduced the gloves. This is in strict contradiction to the bacteriological researches made lately on permeable gloves.

A good many surgeons must have had the idea of using gloves during certain operations long before Mikulicz proposed

[1] I may refer to my publication in the Correspondenzblatt für Schweizer Aertze. . . . "Fort mit dem Catgut!" when I published an uninterrupted series of operative results in using antiseptic silk.

the regular use thereof in 1897. We are told by Lockett that Halsted used rubber gloves already in the spring of 1889. But Robb proposed the same in 1894, and Fœge-Manteuffel in 1897; but the honor of proposing gloves as an indispensable part of a good asepsis during every operation belongs to Perthes (Trendelenburg) and Mikulicz. Though we used gloves sometimes before Mikulicz, we have introduced their general use for all assistants to aseptic operations ever since. Out of the 339 cases of this winter we did not use gloves in 20 cases only, in all others we used cotton gloves, as recommended by Mikulicz. These latter cases were operated without gloves, in the intention to get some cases for comparison; some were operated without because the gloves hindered the free movement of the hand in cases of laparotomy, where we were obliged to move our fingers between the intestines for exploration; or because we had to do with cases where we were afraid of introducing in the gloves infectious germs from without, for instance, with cases of ulcerated cancer or of tubercular disease. We have shown in our tables that we did not find any difference in the cases with or without gloves. The few cases where there seemed to be a less favorable result without gloves were clearly to be explained otherwise than by an infection by the hand, the one by the use of catgut for deep sutures with late formation of abscess, the other by a small wound of the esophagus. Now since Döderlein began his researches on the infection of cotton gloves, concluding that if we express the bloody liquid of a glove in a sterilized research-tube with bouillon or agar we get the development of quantities of germs at once, nobody has been able to prove that his gloves remain sterile during an operation. On the contrary, every one who has repeated the researches of Dödelein knows that without exception germs in notable quantity are to be found in gloves which are soaked with blood and liquid during an operation. If it were true that these germs are falling down from the air of the room, and are not coming from the surface of the hands, as Döderlein admits, it could make little and only quantitative difference to wear impermeable gloves. In this case the conclusion which has

been drawn by a good many surgeons, especially gynecologists, would be simply this, that it is by far better not to wear any gloves whatever, but to wash his hands from time to time in sterilized water, to take off blood and other adhering liquids which might paste on the skin the germs falling down from the surrounding air. as we used to wash the wound during a long operation from time to time with sterilized water, to get rid of air infection.

But the view of Döderlein does not really prove right, according to the researches made by my assistants (especially Dr. Pfähler) during this winter; it was without one exception staphylococcus albus which was found in our gloves during and after operations, and not, as Döderlein says, germs of the most different kinds. Staphylococcus albus is the usual inhabitant of the human skin and evidently remains intact in the deeper layers of it even after we have washed away every germ from the surface. We have to conclude that the infection of the glove comes from the surface of the hand rather than from the air outside. Lockett (working in Keen's and Coplin's laboratory at Jefferson Medical College, Philadelphia) has proved that cotton gloves, even when paraffined according to Menge's method, are really infiltrated with any germ from inside as well; that is to say. from the surface of the non-disinfected hand, or purposely infected hand, as well as from outside, when infectious liquids come in contact with the glove the germs go through it to the skin underneath.

Lockett, therefore, is quite justified in coming to the conclusion that the impermeable or rubber gloves are by far preferable to cotton or silk gloves. Fœge-Manteuffel first proposed to use such gloves for certain operation on a large scale, and Perthes (clinic of Trendelenburg) has recommended the same, though admitting permeable silk gloves as well. Halsted and McBurney seem to have used rubber gloves even before those propositions of German surgeons. But *a priori* we might think it rather strange that all these advocates of gloves, and even rubber gloves, give very categorically the prescription of thorough disinfection of the hands "as if the

gloves were not going to be worn." It is the more strange to hear that, because the principal reason for recommending gloves is "that with the existing methods it is practically impossible to secure absolute disinfection of the hands." We understand perfectly well that we are to wear rubber gloves when it is impossible to wash our hands, as may frequently happen on a battle-field, as Bergmann gives the description of such situation where there was no other water at hand than the antiseptic solutions of ambulance carriage, during the Turco-Russian War. But when we are recommended to wear gloves because it is impossible to disinfect our hands, and at the same moment as earnestly recommended to disinfect our hands before we put on the gloves, what are we to think of such contradiction? Human nature is always longing and searching for perfection, but a wise man makes the best of imperfect means. Surely it is difficult to *sterilize* our hands as well as the patient's skin, but we are able to *disinfect* them easily to that point, that we get sure aseptic healing. What we must ever look out to realize is absolute destruction of every germ, that is, *sterilization;* what we have already arrived at is avoiding to introduce into the wound germs under such conditions and in such quantities that, according to their virulence, they may may develop and exercise poisonous action before the damaged parts have regained the normal protective influence by restoration of good circulation. How could we ever expect to destroy every germ on our wounds if it was true, according to Schimmelbusch's, Ricker's, Neetzel's references, that after five to ten minutes bacteria (virulent or not) are to be found in the circulation and in internal organs when implanted on fresh wounds? But Friedrich and others have also shown that living tissues destroy easily a certain quantity of these germs, especially when they are not yet adapted to the life of these tissues by anterior development, that is to say, when they have not yet arrived to a certain degree of virulence to the human body.

Though the investigations of Magrassi, Marey and others seem exact, that in the follicles, and sometimes in the "lymph-rooms," the skin includes germs to a greater depth, we have

sufficient proof that the normal inhabitants of human skin, as the staphylococcus albus, in the quantities and conditions it is left after thorough cleaning with hot water and alcohol in the deeper layers of the skin, does not interfere with quick and perfect healing of even large wounds. Therefore we do not need sterilization of our hands, but we want to hinder development of germs, that is disinfection. Now virulent germs, which develop quickly, fortunately don't push on to the deeper layers of our skin, except they be directly introduced in the same way as in Garre's well-known experiments with staphylococcus aureus; and if they do, they often give rise to irritation, as eczema, acne, etc.; therefore we need disinfection also of the deeper layers of our skin only in the case when we are suffering from skin disease or when our hands have been *soaked* with highly virulent bacteria. Those which are deposited on our skin from the surrounding air can be easily got rid of by thorough cleansing of our hands and alcohol treatment; deep disinfection is necessary only when we have been obliged to infect our hands with the discharges of infected wounds or organs.

Are we able to realize a sure sterilization of our hands? I am sure, with Fürbringer, Döderlein, Goimer and others, that we are. Even Lockett's experiments are in favor of this. If we brush our hands according to Fürbringer's method, with soap, hot water and alcohol for fifteen minutes or more, and bathe and brush them again for ten minutes in hot one-per-cent sublimate solution, no germ will develop for the following operation. But to sterilize in that way our hands repeatedly in short times is highly dangerous for the health.

Therefore we better avoid touching any infective fluids or septic matter with our hands—and here the question of gloves arises in a much more commanding form. Let us *wear gloves before and between the time of our operations*, wear cotton or leather gloves when we have to touch and examine dirty people in the out-patients' room, wear impermeable gloves whenever we touch an infected wound or open an abscess or make a vaginal or rectal examination.

Gottstein has seen fifty cases of perfect primary union with staphylococcus albus in the stitch-openings, and Schloffer has found in the discharge of nearly every wound already after a few hours the staphylococcus albus, but, thanks to the bactericidal faculties of the wound secretion, it did not develop, except in cases of accumulation of liquids and around aseptic ligatures.

The best gloves certainly are rubber gloves, as recommended by Halsted, Fœge-Manteuffel, Friedrich—only Opttz is of a contrary opinion—but as yet they are so expensive and much too easily to be torn off that it is impossible to use them otherwise than for the cases where infective liquids rise to soak our hands. Against contamination by dry dirt, cotton or silk or leather gloves will do, as bacteria won't go through from the hands at once as long as the skin is dry. Double gloves, as proposed by Perthes, of silk inside and rubber outside, diminish the finer touch of the fingers too much. I need not add that for operations gloves must be sterilized, and this is best done by steam or boiling (soda) water, as for other material.

Surgeons are to wear gloves during professional activity and should be allowed a time without wearing gloves only during their holidays. In doing so we are able to arrive to perfectly sufficient preparation of our hands for operations by the most simple means. As to my own hands, during the whole winter *I never used any chemical antiseptic* before the operation. The preparation consisted exclusively in *cleansing* with soap and brush for fifteen minutes at least under a *stream* of hot water and then brushing with alcohol at 85 per cent. for five or ten minutes, till every particle of skin is thoroughly cleansed. I think it to be very important that we should always use brushes lying in sublimate solution, and cleansing with soap and hot water should be done under a stream of water and not in a basin, and that we should not bring our hands in water again after the alcohol washing. Except in different little details my experience confirms entirely the method of Ahlfeld, quite independent of his view that *alcohol* is a real and strong disinfectant, as is agreed with by Vahle and Reinicke, though Leedham-Green

finds the contrary, and Gönner accepts it only for certain organisms. It may be that it is: then I have to call my cleansing a disinfection. But according to other observers it is only a superficial one, as Krönig thinks to have proved in repeating Reinicke's experiments. I agree with Ahlfeld, that alcohol is far superior to any other liquid for the preparation of our hands, and will be of the utmost importance in war practice, when water may be wanting. Even temperance or abstinent people will agree that in this form it is quite free from danger to our health.

But as long as the question as to the chemical disinfecting properties of alcohol is not settled, I think it to be wise not to rely so much upon these qualities, but to accept as perfectly sure its property to cleanse away from the epidermis every fat and dirt which might include any greater quantities of infective material, to make the latter improper to develop by drawing it off the water, that is to say, to accept its purely physical disinfecting property.[1]

All that has been said for the skin of the surgeon's hands has to be carried on to the hands of every assistant and nurse engaged in the operation, and in the same degree *to the patient's skin.* It was a long time quite astonishing to see surgeons wash and disinfect their own hands for twenty minutes and more, and after that time quickly wash the patient's skin with a little soap and water. I am quite convinced that for a long time more infections of wounds were the consequence of insufficient cleansing of the patient's skin than want of disinfection of the operator's hand, in the practice of many surgeons. In reality a patient's skin is much more dirty, as a rule, much oftener the seat of eczema and small pustules of acne, that is to say, in a severely infected condition, than our own hands. It comes in a very close contact with the wound along the line of incision and, as Landerer remarks, with the threads drawn through the skin.

As a rule, then, the patient's skin needs more care for cleans-

[1] According to Ahlfeld, the disinfecting action of alcohol lies in its entering in the depth of the skin and by drawing off water, destroying even deeper bacteria.

ing and stronger disinfection than the hands. The patient's skin in our clinic is cleansed not only with soap, hot water and alcohol, but still with ether, as ether takes away the fatty dirt more quickly. Besides that, it is an absolute rule that shaving (of the hair) and cleansing with hot water and soap by the brush are to take place *a day before*, and only the final cleansing with ether and alcohol immediately before the operation. When there is the slightest sign of irritation (eczema, acne, etc.) thorough disinfection takes place with an antiseptic solution of sublimate, and the day before operation a glycerin solution of carbolic acid (formol does well also) is rubbed in. My assistants use to wash their hands—after the hot water—alcohol, cleansing still with sublimate or with hydrargyrum oxycyanatum in a 1 per cent. solution. Though no doubt we can arrive at a perfect disinfection of our hands by brushing and soaking them long enough in a 1 per cent. sublimate solution after the above manner of cleansing, I don't think at all that we should unnecessarily poison ourselves (and our patient) by this inhibition with a great quantity of sublimate, except in cases where there has been a real infection with virulent organisms before. Some surgeons cannot bring sublimate on their hands without feeling toothache and diarrhœa coming on very soon, and I do not think that this strong poison can be indifferent even for those surgeons who are not aware of any immediate effect, or for a delicate patient. Why then should we do it every day, when clinical observations prove irrefutably, as I can show by my statistical tabule, that Ahlfeld's modified method is perfectly sufficient?

There is one more point of capital importance in the cleansing of the hands, that is the manner of dealing with the nails. We all know that this is the most difficult part. Why then do we not part with this part entirely? Instead of cleansing the *internagelraum* with special instruments, the only good way is to *cut away the nails entirely* as far as it can be done. I have been struck in the clinic of Mr. Arbuthnot Lane, in London, by the advantage of this method, and have ever since insisted that all my assistants and nurses engaged during my operations

should cut the nails entirely away until to the skin, so that nothing be left which needed any other special cleansing, except rubbing with brush as other parts of the skin. This is not *à la mode des salons* of good society, but I think we are justified in introducing our own fashion in our operating salons. The question of the nails is of such importance that I am satisfied in putting rubber fingers on my hands for infectious examinations, until we shall get rubber gloves less expensive and lasting longer, and even for operations rubber fingers alone will prove of great importance where nails cannot be cleansed sufficiently.

There is a further point of utmost importance to warrant the healing by first intention after our operation, that is the choice of reliable ligatures. As all investigators agree, it is impossible to keep a wound after an operation of any length absolutely sterile; it is only a consequence of this fact that our aseptic ligatures which we put in the wounds must be infected. Döderlein has shown that aseptic sutures become infiltrated with germs, as a rule, when laying in the skin even for a short time. Catgut proved to be infected after eight to ten days in 58.5 per cent. of his cases, and silk in 57 per cent.; even silkworm-gut was found in 41.5 per cent. of cases containing germs; and Schloffer has shown that staphylococcus albus. which is perfectly innocent as a rule, may develop and give exceptionally an abscess, when coming under specially good conditions of life in quiet liquids and in the fibres of aseptic ligatures. Hägler has arrived to quite the same result in examining aseptic ligatures taken out of wounds after a shorter or longer interval. He found, as a rule, between the fibres in the interstices of the thread large quantities of germs on microscopical sections even when the surrounding liquids proved to be free. But this is not only and not even in the first line a consequence of the always existing slight contamination of our wounds with germs, but of an impregnation of the threads during their application. Hägler has shown that it is quite sufficient to draw sterilized silk thread through his fingers, even when these are thoroughly cleansed before an operation, to get

surely infiltration with germs. He therefore recommends to use antiseptic threads exclusively, and assures that ever since this change in using silk no case of thread abscess occurred in the clinic of Professor Socin.

We have long before insisted[1] on the necessity that *the ligature should always be antiseptic and not only aseptic*, so as to work against the possibility of development of germs in the tissue of the thread which we always bring in our wounds during an operation. That catgut is still more apt to be infiltrated with germs than silk, Döderlein and Hägler have found, agreeing together, and clinical observation has undoubtedly proved.[2]

Hägler has found that the thorough impregnation of silk with sublimate keeps very steady during a certain period; therefore antiseptic silk is by far the best material.

But the fact of the easy contamination of our ligatures by the fingers seems to me to constitute a good indication for the use of gloves. If the drawing of a thread through the fingers and hand is sufficient to infect sterile threads in nearly all cases, do we not increase the chance of avoiding this by using gloves? certainly not gloves already soaked with blood or serum, but gloves which are put on just before the ligaturing of the vessels and after stopping hemorrhage by artery forceps. We always leave large quantities of artery forceps in the wound and avoid putting any ligature on before the end, when the wound and fingers have once more been washed with great care. Then the moment has come to use fresh gloves to touch the threads,

[1] Vide Chir. Operationslehre 1, 2d Bd. edition.

[2] We have shown that in two of our three above cases where abscess formed in the wound as a consequence of infection during the operation catgut was used for ligatures By studying the latest communications of Hahn and Heidenhain, one may see that even his newest experiences agree fully with what I said years ago on catgut and silk. I do not deny that there are methods of preparing catgut—for instance, with chromic acid—where catgut is no longer apt to be infiltrated, and to act, as Kiefer says, as *todter Wührboden*; but then, also, it has lost quality of quickly absorbable material and has no more any superiority over silk ligatures, which we can get absolutely sterile and antiseptic in the degree we wish by very simple preparation. We therefore recommend fine *antiseptic silk* as a perfectly reliable material for aseptic healing of wounds, and reserve catgut for infected wounds, inasmuch as it is impossible to avoid ligatures entirely by simple torsion of the vessels.

and *this is the really useful method of employing gloves*, and where cotton and silk gloves will do as well as rubber gloves.

Allow me to allude to the last point of importance for the question of aseptic healing, that is, the most exact stopping of bleeding. The only two cases where, during the whole winter session, secondary infection with formation of an abscess took place were operations with secondary bleeding and formation of hæmatoma. If one has to open and put a drainage-tube in a wound filled with blood the danger of introducing germs in that *Nährboden* is much greater than in the beginning; therefore we are to avoid secondary bleeding if possible, by closing a wound entirely by sutures, without drainage. But where it is impossible to avoid formation of a cavity which must necessarily fill with serous or bloody oozing from the divided vessels we ought to be extremely careful not to get much after-bleeding and put drainage-tubes in every cavity until the moment of further accumulation of liquid in the wound is over. As Freidrich says in his experiments on infection of wounds, so it is with our clinical means, that the *physical* part of the treatment of wounds is by far more important than the chemical one, and therefore gloves must be acknowledged as a step forward under certain conditions.

My conclusion as to the possibility of securing primary union of our operation wounds with or without gloves is the following:

1. *Either:* Do use sterilized rubber gloves for every operation when you wish to be quite independent as to the form of your nails, the touching of everything you like, and the liberty to wash or not to wash your hands, and when you can spend plenty of money. Put your covered hand from time to time in a strong antiseptic solution (best 2 per cent. sublimate) during a long operation, if you wish to be very careful.

2. *Or:* Do never wear gloves for operations, do what you like between your operations, but poison yourself every time before you operate by brushing and bathing your hands for ten minutes in a strong, hot sublimate solution after thorough washing and cleansing with hot water, soap, and alcohol for

fifteen minutes. Repeat a short antiseptic ablution frequently during a long operation when you wish to be very careful.

3. *Or:* Go the golden middle-way; avoid touching with uncovered hands any infective or septic material *between* the operations, or wash it carefully away at once, cut your nails as short as possible, brush your hands thoroughly with hot water, soap, and alcohol (85 to 95 per cent.), avoiding any poisonous disinfectant before you operate, and if you wish to be very careful, put cotton, silk or, best, rubber gloves on when you touch the threads for ligatures and sutures and when you have much to tear the tissues and to rub your fingers in the depth of a wound.

4. But don't forget that the healing of the wounds *per primam intentionem* does not depend exclusively upon your hands, but also upon the same preparation of the patient's skin, upon sterilization of everything else coming in contact with the wound and its surroundings, upon complete arrest of bleeding, exact closing of the wound by sutures, or avoiding accumulation of fluids in cavities necessarily left by drainage, and, last but not least, upon the use of *anti*-septic threads for ligatures and sutures, as long as impermeable threads are not yet invented.

Date.	No.	Disease.	Operation.	Material.	Gloves.	Drainage.	Result.	Date of discharge.
Oct. 1.	1	Appendicitis chron.	Resection processus.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Oct. 21.
" 10.	2	Periorchitis serosa.	Excision.	"	"	Glass tube.	"	" 30.
" "	3	Inguinal hernia.	Radical cure.	"	"	Glass tube.	"	" 30.
" "	4	Varicocele.	Excision of veins.	"	"	None.	"	" 28.
" "	5	Inguinal hernia.	Radical cure.	"	"	"	"	" 27.
" "	6	Varicocele.	Excision of veins.	"	"	"	"	" 21.
" "	7	Inguinal hernia.	Radical cure.	"	"	"	"	" 19.
" "	8	Epigastric hernia.	Radical cure.	"	"	"	"	" 20.
" 11.	9	Goitre.	Excision.	"	"	Glass tube.	"	" 19.
" 11.	10	Goitre.	Excision.	"	"	Glass tube.	"	" 19.
" 13.	11	Dislocation clavicle.	Suture with silk.	"	"	None.	"	Nov. 9.
" "	12	Fracture patella.	Suture with silk.	"	"	Glass tube.	"	Nov. 9.
" "	13	Complicated fracture of leg (infected).	Amputation (osteoplastic).	"	"	"	"	Dec. 20.
" "	14	Cancer of breast.	Amputation.	"	"	"	"	Nov. 14.
" 17.	15	Goitre.	Excision.	"	"	"	"	Oct. 24.
" "	16	Sarcoma cutis.	Excision.	"	"	None.	"	Nov. 5.
" "	17	Inguinal hernia.	Radical cure.	"	"	Glass tube.	"	" 1.
" "	18	Appendicitis chron.	Resection processus.	"	"	None.	"	" 1.
" 18.	19	Goitre.	Excision.	"	"	Glass tube.	"	Oct. 25.
" "	20	Gonitis tuberculosa.	Resection of knee.	"	"	"	"	Dec. 12.
" "	21	Goitre.	Excision.	"	"	"	"	Oct. 25.
" "	22	Inguinal hernia.	Radical cure.	"	"	"	"	" 28.
" "	23	Inguinal hernia.	Radical cure.	"	"	None.	"	" 28.
" 19.	24	Goitre.	Excision.	"	"	Glass tube.	"	" 26.
" "	25	Sarcoma of cranium.	Excision.	Juniperus catgut.	"	Glass tubes and iodoform gauze.	"	Nov. 21.
" "	26	Inguinal hernia.	Radical cure.	Antiseptic silk.	"	None.	"	Oct. 28.
" "	27	"	"	"	"	"	"	" "
" 20.	28	"	"	"	"	"	"	" "
" 20.	29	Glandulæ sarcomatosæ.	Excision.	"	"	Glass tube.	"	" 27.
" 21.	30	Tuberculosis ulna.	Osteotomy.	"	No gloves.	Glass tube.	"	Nov. 4.
" 22.	31	Inguinal hernia.	Radical cure.	"	Gloves.	None.	"	" 7.
" 22.	32	Prolapsus uteri.	Ventrofixation.	"	Gloves.	"	"	" 7.
" 24.	33	Varices.	Ligature of vein.	"	No gloves.	"	"	
" "	34	Varices.	Ligature of vein.	"	No gloves.	"	"	" 11.
" "	35	Inguinal hernia.	Radical cure.	"	Gloves.	"	"	" 5.
" 25.	36	Goitre.	Excision.	"	"	Glass tube.	"	" 7.
" "	37	Acondritis dissecans genu.	Arthrotomy.	Juniperus catgut.	"	Glass tube.	Abscess from deep sutures, staphylococcus aureus.	Jan. 1.

Date.	No.	Disease.	Operation.	Material.	Gloves.	Drainage.	Result.	Date of discharge.
Oct. 25.	38	Acondritis dissecans genu.	Arthrotomy.	Antiseptic silk.	Gloves.	Glass tube.	Prima intentio.	Nov. 29.
" "	39	Intestinal obstruction by adhesions.	Laparotomy.	"	"	None.	"	" 7.
" 26.	40	Goitre.	Excision.	"	"	Glass tube.	"	" 3.
" "	41	Inguinal hernia.	Radical cure.	"	"	None.	"	" 6.
" "	42	Tuberculosis manus.	Resection.	"	"	Glass tube.	"	" 25.
" 28	43	Graves's disease.	Ligature of arteries.	"	"	"	"	" 18.
" "	44	Graves's disease.	Excision of goitre.	"	"	"	Death 3 days, wounds healed.	
" "	45	Goitre.	Enucleation.	"	"	"	Prima intentio.	" 21.
" 29.	46	"	Excision.	"	"	"	"	" 5.
" "	47	"	Excision.	"	"	"	"	" 5.
" "	48	Crural hernia.	Radical cure.	"	"	None.	"	" 7.
" "	49	Inguinal hernia.	"	"	"	"	"	" "
" "	50	Inguinal hernia.	"	"	"	"	"	" "
" 31.	51	Lipoma.	Excision.	"	"	"	"	" 5.
" "	52	Incarcerated hernia.	Herniotomy.	"	"	"	Death 4 days, pneumonia.	
" "	53	Inguinal hernia.	"	"	"	"	Death 4 days, pneumonia.	
" "	54	Umbilical hernia.	"	"	"	"	Death 4 days, pneumonia.	
" "	55	Complicated fracture of tibia.	Suture of the vein.	Silver wire.	"	Glass tube.	Prima intentio.	" 15.
Nov. 1.	56	Angioma.	Excision.	Antiseptic silk.	"	None.	"	" 10.
" "	57	Inguinal hernia and retroflexio uteri.	Radical cure. Alexander's operation.	"	"	"	"	" 22.
" "	58	Hydrocele.	Excision.	"	"	"	"	" 10.
" "	59	Inguinal hernia.	Radical cure.	"	"	"	"	" 12.
" 2.	60	Tubercular glands.	Excision.	"	No gloves.	Glass tube.	"	" 16.
" 3.	61	Inguinal hernia.	Radical cure.	"	Gloves.	None.	"	" 12.
" "	62	Inguinal hernia.	Radical cure.	"	"	None.	"	" 12.
" "	63	Sarcoma of sternum.	Excision.	"	"	Iodoform gauze.	"	" 21.
" "	64	Contracture and ankylosis of knee-joint.	Resection.	"	No gloves.	None.	"	" 12.
" "	65	Tubercular hip.	Resection.	"	Gloves.	Glass tubes.	"	Jan. 21.
" "	66	Carcinoma labii.	Excision.	"	No gloves.	None.	"	Nov. 12.
" "	67	Carcinomat. glands.	Excision.	"	No gloves.	None.	"	" 12.
" 4.	68	Luxatio patellæ dextræ.	Partial tenotomy of quadriceps.	"	Gloves.	Glass tube.	"	" 21.

Nov.	4.	69	Luxatio patellæ sinistræ.	Partial tenotomy of quadriceps.	Antiseptic silk.	Gloves.	Glass tube.	Prima Intentio.	Nov.	21.
"	"	70	Goitre.	Excision.	"	"	"	"	"	12.
"	"	71	Inguinal hernia.	Radical cure.	"	"	None.	"	"	18.
"	"	72	Traumatic urethral stricture.	Silk suture after excision.	"	"	"	"	"	18.
"	"	73	Varices.	Ligature of vena saphena major.	"	"	"	"	"	26.
"	"	74	Varices.	Ligature of vena saphena major.	"	"	"	"	"	26.
					"	"	Glass tube.	"	"	17.
"	5.	75	Goitre.	Excision.						
"	"	76	Goitre.	Excision.	"	"	None.	"	"	13.
"	"	77	Inguinal hernia.	Radical cure.	"	"	"	"	"	15.
"	"	78	Malrolobium.	Excision.	Juniperus catgut.	No gloves.	"	"	"	10.
"	"	79	Crural hernia.	Radical cure.	Antiseptic silk.	Gloves.	"	"	"	18.
"	"	80	Inguinal hernia.	Radical cure.	"	"	"	"	"	18.
Nov.	7.	81	Carcinoma pylori.	Resection of pyloris.	"	"	None.	"	Dec.	11.
"	7.	82	Appendicitis with perforation.	Resection appendix.	Juniperus catgut.	"	Iodoform gauze.	"	Nov.	24.
Nov.	8.	83	Old dislocation of radius.	Resection of the upper end.	Antiseptic silk.	No gloves.	None.	"	Nov.	17.
"	"	84	Old dislocation of radius.	Resection of the upper end.	"	Gloves.	"	"	"	19.
"	"	85	Fractura supracondylica humeri male sanata.	Excision of triangular piece of bone.	"	"	"	"	Dec.	12.
"	"	86	Ulcus ventriculi.	Laparotomy.	"	"	"	"	Nov.	24.
"	"	87	Goitre.	Excision.	"	"	Glass tube.	"	Nov.	17.
"	9.	88	" (spondylitis).	Excision.	"	"	"	"	Dec.	12.
"	"	89	"	Enucleation.	"	"	"	"	Nov.	19.
"	"	90	Inguinal hernia.	Radical cure.	"	"	None.	"	"	18.
"	"	91	Inguinal hernia.	Radical cure.	"	"	"	"	"	24.
"	10.	92	Dislocation of int. meniscus.	Excision of meniscus.	"	"	"	"	"	28.
"	"	93	Fracture pertubercularis humeri male sanata.	Reposition of fragments.	"	"	Glass tube.	"	Jan.	19.
"	"	94	Tuberculosis cæci et coli ascend.	Resection of intestine.	"	"	None.	"	Nov.	25.
"	11.	95	Epilepsy.	Trephining.	"	"	Silver tube.	"	Nov.	25.
"	11.	96	Old fracture lower end humerus.	Resection.	"	"	Glass tube.	"	Dec.	10.
"	14.	97	Goitre.	Excision.	"	"	"	"	Nov.	22.
"	"	98	Sarcoma of nervus ulnaris.	Excision, suture of nerve.	Juniperus catgut.	"	"	"	Dec.	5.
"	"	99	Adenoma mammæ.	Excision.	Antiseptic silk.	"	None.	"	Nov.	22.
"	15.	100	Crural hernia.	Radical cure.	"	"	"	"	"	24.
"	15.	101	Inguinal hernia.	Radical cure.	"	"	"	"	"	"

Date.	No.	Disease.	Operation.	Material.	Gloves.	Drainage.	Result.	Date of discharge.
Nov. 15.	102	Inguinal hernia.	Radical cure.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Nov. 21.
" "	103	Inguinal hernia.	Radical cure.	"	"	None.	Prima intentio.	" 21.
" 17.	104	Malignant goitre.	Excision, resection of trachea.	"	"	Iodoform gauze.	Death 3 days, pneumonia.	
" "	105	Appendicitis recidiva.	Resection of processus vermiformis.	"	"	None.	Prima intentio.	" 27.
" "	106	Fracture of scapula.	Suture with silver wire.	"	"	Glass tube.	"	" 29.
" 18.	107	Inguinal hernia.	Radical cure.	"	"	None.	"	" 27.
" "	108	Inguinal hernia.	Radical cure.	"	"	None.	"	" 27.
" "	109	Goitre.	Excision.	"	"	Glass tube.	"	" 29.
" "	110	Epilepsy.	Trephining.	"	"	Silver tube.	"	Dec. 9.
" "	111	Pseudarthrosis femoris.	Suture.	Aluminium-bronze wire.	No gloves.	Iodoform gauze.	"	Jan. 24.
" 19.	112	Goitre.	Excision.	Antiseptic silk.	Gloves.	Glass tube.	"	Nov. 26.
" 19.	113	Olenitis tuberculosa recidiva.	Resection.	"	"	Glass tube.	"	Dec. 12.
" 20.	114	Incarcerated inguinal hernia.	Herniotomy.	"	"	None.	"	Dec. 2.
" 21.	115	Goitre.	Excision.	"	"	Glass tube.	"	Nov. 28.
" "	116	Varicocele.	Excision of vena spermatica.	"	"	None.	"	" 29.
" "	117	Inguinal hernia.	Radical cure.	"	"	"	"	" 29.
" "	118	Congenital hernia.	Radical cure.	"	"	"	"	Dec. 2.
" 22.	119	Sarcomata uteri.	Supravaginal amputation.	"	"	"	"	Dec. 12.
" 22.	120	Tuberculosis sterni.	Excision.	"	"	Iodoform gauze.	"	Jan. 30.
" 23.	121	Congenital stenosis of pylorus.	Gastro-enterostomy.	"	"	None.	"	Dec. 7.
" 23.	122	Goitre.	Excision.	"	"	Glass tube.	"	" 3.
" 24.	123	Hernia ileo-appendicularis.	Laparotomy.	"	"	None.	"	" 10.
" "	124	Graves's disease.	Ligature of superior arteries.	"	"	"	"	" 11.
" "	125	Ankylosis cotæ.	Osteotomia subtrochanterica.	"	"	"	"	Feb. 2.
" "	126	Club-foot.	Phelp's operation.	"	"	Iodoform gauze.	"	Dec. 15.
" "	127	Club-foot.	Resectio mediotarsea.	"	"	None.	"	" 15.
" 25.	128	Carcinoma mammæ.	Amputation.	"	"	Glass tubes.	"	" 19.
" "	129	Malignant goitre.	Excision.	"	"	Glass tubes.	"	" 5.
" "	130	Epilepsy.	Trephining.	"	"	Silver tube.	"	Mar. 11.

Nov.	26.	131	Inguinal hernia.	Radical cure.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Dec.	5.
"	"	132	Glandulæ sarcomatosæ colli.	Excision.	"	"	Glass tube.	"	Nov.	26.
"	"	133	Goitre.	Excision.	"	"	"	"	Dec.	5.
"	"	134	Inguinal hernia with processus vermif.	Resection of processus, radical cure of hernia.	"	"	"	"	"	8.
"	"	135	Inguinal hernia.	Radical cure.	"	"	None.	"	"	5.
"	"	136	Inguinal hernia.	Radical cure.	"	"	"	"	"	5.
"	28.	137	Luxatio humeri habitualis.	Suture of capsule.	"	"	"	"	"	24.
"	"	138	Graves's disease.	Ligatures of superior arteries, two incisions.	"	"	"	Right side prima intentio, left side retention of air, slight infection.	"	24.
"	"	139	Appendicitis.	Resection processus.	"	"	"	Prima intentio.	"	10.
"	"	140	Chondroma digit.	Excision.	"	"	Iodoform gauze.	"	"	12.
"	29.	141	Tuberculosis testis hydrocele vaginalis.	Excision with castration.	"	"	None.	"	"	8.
"	30.	142	Goitre.	Excision.	"	"	Glass tube.	"	"	7.
"	"	143	Goitre.	Excision.	"	"	"	"	"	6.
"	"	144	Laceration of upper limb.	Ablatio humeri alta.	"	"	"	"	"	25.
"	"	145	Hernia inguinalis per vagna.	Radical cure.	"	"	"	Prima intentio, large hematoma.	Jan.	8.
Dec.	2.	146	Incarcerated hernia.	Herniotomy.	"	"	None.	Prima intentio.	Dec.	13.
"	"	147	Goitre.	Excision.	"	"	Glass tube.	"	Dec.	10.
"	"	148	Epilepsy.	Trephining.	"	"	Silver tube.	"	Jan.	15.
"	3.	149	Graves's disease.	Ligature of arteries.	"	"	None.	"	Dec.	27.
"	"	150	Goitre.	Excision.	"	"	Glass tube.	"	"	10.
"	"	151	"	"	"	"	"	"	"	"
"	"	152	"	"	"	"	"	"	"	"
Dec.	2.	153	Carcinoma labii with glands.	Excision.	Antiseptic silk.	Gloves.	None.	"	Dec.	10.
"	5	154	Inguinal hernia.	Radical cure.	"	"	"	"	"	13.
"	"	155	Inguinal hernia.	Radical cure.	"	"	"	"	"	13.
"	"	156	Meningocele lumbalis.	Excision.	Aluminium-bronze wire.	"	"	"	"	22.
"	"	157	Appendicitis.	Resection of processus vermiformis.	Antiseptic silk.	"	"	"	"	13.
"	6.	158	Inguinal hernia.	Radical cure.	"	"	"	"	"	14.
"	6	159	Goitre.	Excision.	"	"	Glass tube.	"	"	19.
"	7.	160	Goitre (spondylitis).	Excision.	"	"	Glass tube.	"	Jan.	14.
"	"	161	Inguinal hernia.	Radical cure.	"	"	None.	"	Dec.	16.
"	"	162	Incarcerated inguinal hernia.	Herniotomy.	"	"	None.	"	"	17.

Date.	No.	Disease.	Operation.	Material.	Gloves.	Drainage.	Result.	Date of discharge.
Dec. 7.	163	Inguinal hernia.	Radical cure.	Antiseptic silk.	Gloves.	Glass tube.	Prima intentio.	Dec. 31.
" 7.	164	"	"	"	"	Glass tube.	"	" 16.
" 8.	165	"	"	"	"	None.	"	" 17.
" "	166	Osteomalaeia.	Double ovariotomy.	"	"	"	"	Feb. 15.
" "	167	Ulcus ventriculi.	Gastro-enterostomy.	"	"	"	"	
" "	168	Inguinal hernia.	Radical cure.	"	"	"	"	Dec. 17.
" "	169	Inguinal hernia.	Radical cure	"	"	"	"	" 17.
" "	170	Old dislocation of radius.	Open reposition.	"	"	"	"	" 24.
" 9.	171	Prolapsus uteri.	Ventrifixation.	"	"	"	"	" 26.
" "	172	Gastrectasia.	Gastro-enterostomy.	"	"	"	"	Jan. 14.
" "	173	Lablum leporium.	Suture.	"	"	"	"	Dec. 23.
" "	174	Gonitis tuberculosa.	Resectio genu.	"	"	Glass tubes.	"	Dec. 29.
" "	175	Ventral hernia.	Herniotomy.	"	"	Glass tubes.	"	Jan. 9.
" 10.	176	Traumatic epilepsy.	Trephining.	"	"	Silver tube.	"	Dec. 27.
" "	177	Tortieollis spasticus.	Trephining.	"	"	Silver tube.	"	Jan. 12.
" "	178	Fracture of vertebra with paraplegia.	Laminectomy.	"	"	Glass tube.	"	Mar. 30.
" 12.	179	Epigastric hernia.	Radical cure.	"	"	None.	"	Dec. 21.
" "	180	Corpus liberum genu.	Arthrotomy.	"	"	Glass tube.	"	Jan. 5.
" "	181	Goitre.	Excision.	"	"	Glass tube.	"	Dec. 24.
" "	182	Ulcus ventriculi.	Gastro enterostomy.	"	"	None.	"	" 31.
" "	183	Inguinal hernia.	Radical cure.	"	"	"	"	" 24.
" "	184	Inguinal hernia.	Radical cure.	"	"	"	"	" 24.
" 13.	185	Epilepsy.	Trephining.	"	"	Silver tube.	"	Jan. 23.
" 13.	186	Sarcoma mammae.	Amputation.	"	"	Glass tube.	"	" 15.
" 14.	187	Inguinal hernia.	Radical cure.	"	"	None.	"	" 22.
" "	188	"	"	"	"	"	"	" 22.
" "	189	"	"	"	"	"	"	Dec. 22.
" "	190	"	"	"	"	"	"	" 22.
" 15.	191	Hydrocele biliocularis vaginalis.	Excision.	"	"	Glass tube.	"	" 24.
" "	192	Periorchitis serosa.	"	"	"	None.	"	" 23.
" "	193	Struma.	"	"	"	Glass tube.	"	" 24.
" "	194	Appendicitis.	Resection of processus vermiformis.	"	"	None.	"	" 24.
" "	195	Luxatio cubiti inveterata.	Resectio cubiti.	"	"	Glass tubes.	"	Jan. 19.
" 16.	196	Genu valgum.	Osteotomia supracondylica.	"	"	Glass tubes.	Hematoma 2 weeks, secondary infection.	Feb. 16.
" 17.	197	Prolapsus uteri.	Ventrifixatio.	"	"	None.	Prima intentio.	Jan. 8.
" 17.	198	Crural hernia.	Radical cure.	"	"	None.	Prima intentio.	Jan. 10.

Dec.	17.	199	Varices.	Ligature of vena saphena major.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Jan.	10.
"	"	200	Pes varus.	Resectio medio-tarsea.	"	"	None.	"	Jan.	19.
"	"	201	Goitre.	Excision.	"	"	Glass tube.	"	Dec.	26.
"	19.	202	Gastrectasia.	Gastro-enterostomy.	"	"	None.	"	Jan.	12.
"	19.	203	Complicated fracture of tibia and fibula.	Ablatio femoris osteoplastica.	"	"	Glass tube.	"	Feb.	2.
"	20.	204	Inguinal hernia.	Radical cure.	"	"	None.	"	Dec.	28.
"	"	205	Varicocele.	Excision of veins.	"	"	"	"	Dec.	28.
"	"	206	Appendicitis.	Resection of processus vermiformis.	"	"	"	"	Jan.	11.
"	"	207	Tuberculosis pedis.	Resectio pedis.	"	"	Iodoform gauze.	"	"	21.
"	22.	208	Papilloma ovarii.	Excision.	Juniperus catgut.	No gloves.	None.	Three weeks abscess, staphylococcus aureus.	"	29.
"	22.	209	Gastrectasia.	Gastro-enterostomy.	Antiseptic silk.	Gloves.	"	Prima intentio.	Dec.	31.
"	26.	210	Gastrectasia.	Laparotomy.	"	"	"	"	Jan.	24.
"	26.	211	Torticollis spasticus.	Dividing the muscles.	"	"	Glass tube.	"	Mar.	4.
"	27.	212	Goitre.	Excision.	"	"	Glass tube.	Large hematoma 2 weeks, secondary infection, staphylococcus aureus.	Jan.	23.
"	"	213	Inguinal hernia.	Radical cure.	"	"	None.	Prima intentio.	"	5.
"	"	214	Inguinal hernia.	Radical cure.	"	"	None.	"	"	5.
"	29.	215	Goitre.	Excision.	"	"	Glass tube.	"	"	7.
"	"	216	Carcinoma pylori inoperabile.	Laparotomy.	"	"	None.	Prima intentio, death 3 weeks after operation.		
"	"	217	Inguinal hernia.	Radical cure.	"	"	"	Prima intentio.	"	5.
"	"	218	Inguinal hernia.	"	"	"	"	"	"	5.
"	"	219	Umbilical hernia.	"	"	"	"	"	"	10.
Jan.	3.	220	Fractura supracondylica humeri inveterata.	Resection of a part of dislocated fragment.	"	"	"	"	"	21.
"	"	221	Goitre.	Excision.	"	No gloves.	"	"	"	11.
"	"	222	Goitre.	Excision.	"	Gloves.	"	"	"	11.
"	"	223	Fracture of cranium with hemiplegia.	Trephining.	"	"	Silver tube.	"	"	31.
"	"	224	Pes varus congenitus.	Resection of lower end of fibula.	"	"	None.	"	"	23.
"	10.	225	Traumatic aneurism brachial artery.	Incision. Ligature.	"	"	Glass tube.	"	"	23.
"	"	226	Inguinal hernia.	Radical cure.	"	"	None.	"	"	19.
"	"	227	Inguinal hernia.	Radical cure.	"	"	"	"	"	19.
"	"	228	Ventral hernia.	Herniotomy.	"	"	"	"	"	28.
"	10.	229	Goitre.	Excision.	"	"	Glass tube.	"	"	17.

Date.	No.	Disease.	Operation.	Material.	Gloves.	Drainage.	Result.	Date of discharge.
Jan. 12.	230	Gastrectasia.	Gastro-enterostomy.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Jan. 23.
" 12.	231	Goitre.	Enucleation.	"	"	Glass tube.	"	" 20.
" 13.	232	Goitre.	Excision.	"	"	Glass tube.	"	" 19.
" "	233	Pes varus congenit.	Resectio mediotarsea.	"	"	None.	"	Feb. 3.
" "	234	Hydrocele vaginalis.	Excision.	"	"	"	"	" 11.
" 14.	235	Contracture of finger.	Exarticulatio digiti IV et V.	"	"	"	"	" 17.
" 17.	236	Carcinoma esophagi.	Gastrostomy.	"	"	Glass tubes.	"	Jan. 31.
" "	237	Goitre.	Excision.	"	"	Glass tubes.	"	" 26.
" "	238	Appendicitis.	Resection of processus vermiformis.	"	"	None.	"	" 29.
" "	239	Incarcerated inguinal hernia.	Herniotomy, resection of intestine.	"	"	Glass tube.	"	" 31.
" 18.	240	Inguinal hernia.	Radical cure.	"	"	None.	"	" "
" "	241	"	"	"	"	"	"	" "
" "	242	"	"	"	"	"	"	" "
" 19.	243	Olenitis tuberculosa.	Resectio cubiti.	"	"	Iodoform gauze.	"	Feb. 10.
" 20.	244	Bursitis præpatellaris.	Excision of bursa.	"	"	Glass tube.	"	" 6.
" "	245	Bursitis semimembranosa.	Excision of bursa.	"	"	None.	"	" 6.
" "	246	Carcinoma pylori.	Resectio pylori.	"	No gloves.	None.	Death 2 days after operation, pneumonia.	
" "	247	Goitre.	Excision.	"	Gloves.	Glass tube.	Prima intentio.	Jan. 28.
" 21.	248	Umbilical hernia.	Radical cure.	"	"	"	"	" "
" "	249	Goitre.	Excision.	"	"	"	"	" "
" "	250	Goitre.	Excision.	"	"	"	"	" "
" 24.	251	Inguinal hernia.	Radical cure.	"	"	None.	"	Feb. 3.
" "	252	Inguinal hernia.	Radical cure.	"	"	None.	"	" 3.
" "	253	Fibrosarcoma of musc. gluteus.	Excision.	"	"	Glass tube.	"	" 7.
" 26.	254	Neuralgia from scoliosis.	Resectio costæ XII.	"	"	None.	"	" 6.
" 26.	255	Appendicitis with abscess (pyocyaneus).	Resection of processus vermiformis.	"	"	None.	After 10 days abscess, pure pyocyaneus.	" 23.
" 27.	256	Struma colloides.	Excision.	"	"	Glass tube.	Prima intentio.	" 2.
" "	257	Inguinal hernia.	Radical cure.	"	"	None.	"	" 2.
" "	258	Ulcus rodens nasi.	Excision.	"	No gloves.	"	"	" 4.
" 28.	259	Carcinoma pylori.	Gastro-enterostomy.	"	Gloves.	"	"	" 6.
" 28.	260	Incarcerated crural hernia.	Herniotomy.	"	Gloves.	"	"	" 9.

Jan.	28.	261	Incarcerated inguinal hernia.	Herniotomy.	Antiseptic silk.	No gloves.	None.	Prima intentio.	Feb. 9.
"	30.	262	Dupuytren's contracture.	Exarticulatio digiti V.	"	No gloves.	Glass tube.	"	" 4.
"	31.	263	Genu valgum traumat.	Osteotomia tibiæ.	"	Gloves.	None.	"	" 16.
"	31.	264	Carcinoma maxillæ infer.	Excision.	Juniperus catgut.	No gloves.	Iodoform gauze.	"	" 28.
Feb.	1.	265	Goitre.	Excision.	Antiseptic silk.	Gloves.	Glass tube.	"	" 8.
"	"	266	Inguinal hernia.	Radical cure.	"	"	None.	"	" 8.
"	"	267	Inguinal hernia.	Radical cure.	"	"	None.	"	" 9.
"	"	268	Gonitis tuberculosa.	Resectio genu.	"	"	Glass tubes.	"	" 26.
"	2.	269	Goitre.	Excision.	"	"	Glass tubes.	"	" 12.
"	"	270	Cystic goitre, abscess.	"	Juniperus catgut.	No gloves.	Glass tube.	"	" 15.
"	"	271	Tubercular glands.	"	Antiseptic silk.	"	None.	"	" 9.
"	3.	272	Graves's disease.	Excision of goitre.	"	"	Glass tube.	"	" 18.
"	"	273	Epilepsy.	Trephining.	"	Gloves.	Silver tube.	"	" 17.
"	"	274	Goitre.	Excision.	"	"	Glass tube.	"	" 17.
"	"	275	Crural hernia.	Radical cure.	"	"	None.	"	" 11.
"	4.	276	Carcinoma pancreatis.	Gastro-enterostomy.	"	"	None.	"	" 13.
"	"	277	Epilepsy.	Trephining.	"	"	Silver tube.	"	Mar.
"	"	278	Epilepsy.	Trephining.	"	"	Silver tube.	"	Feb. 28.
"	6.	279	Inguinal hernia.	Radical cure.	"	"	None.	"	" 14.
"	"	280	"	"	"	"	"	"	" 15.
"	"	281	"	"	"	"	"	"	" "
"	"	282	Umbilical hernia.	"	"	"	"	"	" "
"	"	283	Crural hernia.	"	"	"	"	"	" "
"	"	284	Pes varus congenital.	Resectio mediotarsea.	"	"	"	"	" 20
"	7.	285	Carcinoma œsophagi.	Gastrostomy.	"	"	Glass tubes.	"	Mar. 4.
"	"	286	Pseudarthrosis antebrachii.	Bone suture.	Bronze-aluminium wire.	"	Iodoform gauze.	"	Feb. 28.
"	"	287	Gangrena digit. pedis.	Exarticulatio digiti I and II.	Antiseptic silk.	No gloves.	None.	"	" 21.
"	9.	288	Luxatio cubiti inveterata	Arthrectomy.	"	Gloves.	Glass tube.	"	" 20.
"	"	289	Luxatio cubiti inveterata.	Resectio cubiti.	"	"	Glass tube.	"	Mar. 18.
"	"	290	Fractura supracondylica inveterata.	Triangular excision of humerus.	"	"	None.	"	Feb. 28.
"	"	291	Fractura condyli ext. humeri male sanata.	Excision of external condyle.	"	"	None.	"	" 28.
"	10.	292	Sarcoma colli.	Excision.	"	"	Iodoform gauze.	"	" 18.
"	"	293	Epilepsy.	Trephining.	"	"	Silver tube.	"	Mar. 4.
"	"	294	Carcinoma mammæ.	Amputation.	"	"	Glass tube.	"	" 25.
"	11.	295	Goitre.	Excision.	"	"	Glass tube.	"	Feb. 18.
"	11.	296	Epilepsy.	Trephining.	"	"	Silver tube.	"	Mar. 16.

Date.	No.	Disease.	Operation.	Material.	Gloves.	Drainage.	Result.	Date of discharge.
Feb. 11.	297	Incarcerated crural hernia.	Herniotomy.	Antiseptic silk.	Gloves.	None.	Abscess 8 days, staphylococcus aureus. Patient touched wound during operation.	Mar. 4.
" "	298	Crural hernia.	Radical cure.	"	"	"	Prima intentio.	Feb. 18.
" "	299	Crural hernia.	Radical cure.	"	"	"	"	" 18.
" 13.	300	Fracture os frontis, depression.	Excision fragments.	"	"	Glass tube.	"	" 27.
" "	301	Inguinal hernia.	Radical cure.	"	"	None.	"	" 21.
" "	302	"	"	"	"	"	"	" 21.
" "	303	"	"	"	"	"	"	" 21.
" "	304	"	"	"	"	"	"	" 21.
" "	305	"	"	"	"	"	"	" 24.
Feb. 13.	306	Crural hernia.	Radical cure.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Feb. 24.
" "	307	Crural hernia.	"	"	"	None.	"	" 21.
" 14.	308	Goitre.	Excision.	"	"	Glass tube.	"	" 21.
" "	309	Inguinal hernia.	Radical cure.	"	"	None.	"	" 20.
" "	310	Inguinal hernia.	Radical cure.	"	"	"	"	" 20.
" "	311	Appendicitis.	Resection of processus vermiformis.	"	"	"	"	" 28.
" 15.	312	Crural hernia.	Radical cure.	"	"	"	"	" 25.
" "	313	Inguinal hernia.	"	"	"	Glass tube.	"	" 25.
" "	314	Inguinal hernia.	"	"	"	"	"	" 25.
" "	315	Tubercular glands.	Excision.	Juniperus catgut.	"	"	"	" 25.
" 16.	316	Hydrocele vaginalis.	Excision.	Antiseptic silk.	"	None.	"	" 22.
" 16.	317	Inguinal hernia.	Radical cure.	"	"	None.	"	" 28
" 17.	318	Graves's disease.	Excision of goitre.	"	"	Glass tube.	"	Mar. 9.
" 17.	319	Graves's disease.	Excision of goitre.	"	"	Glass tube.	"	Mar. 9.
" 18.	320	Inguinal hernia.	Radical cure.	"	"	None.	"	Feb. 28.
" "	321	Crural hernia.	Radical cure.	"	"	None.	"	" "
" "	322	Goitre.	Excision.	"	"	Glass tube.	"	" "
" "	323	Congenital goitre, child 3 months.	"	"	"	None.	Infection from small opening in esophagus.	Mar. 11.
" "	324	Hydrocele vaginalis.	"	"	"	None.	Prima intentio.	Feb. 24.
" "	325	Torticollis spasticus.	Dividing of muscles.	"	"	Glass tube.	"	Mar. 4.
" 20.	326	Congenital hernia.	Radical cure.	"	"	None.	"	Feb. 28.
" "	327	Malignant goitre.	Excision.	"	No gloves.	Iodoform gauze.	"	Mar. 4.
" "	328	Inguinal hernia.	Radical cure.	"	Gloves.	None.	"	Feb. 28.
" "	329	Inguinal hernia.	Radical cure.	"	Gloves.	None.	"	Feb. 28.

Feb.	20.	330	Crural hernia.	Radical cure.	Antiseptic silk.	Gloves.	None.	Prima intentio.	Feb. 28.
"	21.	331	Cancer of colon ascend.	Excision, resection of colon and ileum.	"	"	"	"	Mar. 12.
"	22.	332	Malignant goitre.	Excision.	"	"	Glass tube.	"	" 4.
"	"	333	Goitre.	Excision.	"	"	Glass tube.	"	" 4.
"	"	334	Inguinal hernia.	Radical cure.	"	"	None.	"	" 2.
"	23.	335	Gastrectasia.	Gastro-enterostomy.	"	"	None.	"	" 12.
"	24.	336	Fibrosarcoma muscle.	Excision.	"	"	Glass tube.	"	" 12.
"	24.	337	Omarthritis tuberculosa.	Resectio humeri.	Juniperus catgut.	"	Glass tube.	"	"
"	27.	338	Carcinoma pylori.	Resectio pylori.	Antiseptic silk	"	None.	"	"
"	28.	339	Carcinoma esophagi.	Gastrostomy.	Antiseptic silk.	"	Iodoform gauze.	"	" 14.

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DISCUSSION.

Dr. Nicholas Senn, of Chicago.

There is not very much room for discussion of this able paper, although I believe with reference to hand disinfection that the simpler the process the more sure will be the results. I, however, have serious doubts in reference to the reliability of absolute disinfection of the hands simply by the use of potash soap, hot water, and alcohol. We all recognize that alcohol is one of the most efficient means with which to effect disinfection of the hands, but I doubt whether it can be relied upon exclusively. I have tried in my own practice various methods of hand disinfection for years, and I finally came back to one of the old procedures with which I became familiar in 1888 in the clinic of Prof. Ogston, of Aberdeen, Scotland. At that time I was informed by the discoverer of pus microbes that he would have absolutely no hesitation in going from the post-mortem room into the operating-room and performing a laparotomy after thoroughly disinfecting his hands with turpentine. The way I proceed now is to this effect: As nearly as can be done, I resort to mechanical cleansing of the hands with hot water and potash soap; I bathe and scrub them very thoroughly with spirits of turpentine, afterward alcohol, and then I am doubly sure. I never hesitate to immerse my hands for a considerable length of time or minutes in a strong solution of bichloride of mercury, but never stronger than 1 : 1000. Immediately before operating I wash away any of the antiseptics that may remain on the surface of the hands by immersion and bathing in plain normal salt solution. I have abandoned entirely the use of sterilized water either for hand cleansing or for cleansing the field of operation. I believe sterile water is objectionable, and I have supplanted it entirely by the use of the normal salt solution, which is always on hand. I think that we are all deeply indebted to Prof. Kocher, and that we shall perhaps modify our practice in the future in consequence of his very valuable instruction.

Dr. Leonard Freeman, of Denver, Colo.

In the early days of surgical cleanliness the sterilization of the hands was supposed to be easy of accomplishment, but we have gradually learned that it is an exceedingly difficult and complicated

problem. The micro-organisms, unfortunately, are not strewn upon the surface of the skin like grains of salt upon a plate, but they lie in creases, between and beneath the epithelial scales, and down deep in hair follicles and the openings of sweat glands. The regions about the nails offer particularly favorable hiding-places. It is extremely difficult to reach all these micro-organisms with antiseptics, not only on account of their impregnable positions, but also because they are protected by grease and by being bunched together. The full significance of this bunching together is not always recognized. An antiseptic will kill the germs on the outside of the bunch, but cannot reach those within. Some time ago I dried portions of a culture of the staphylococcus pyogenes aureus on a platinum wire and immersed the instrument for half an hour in 5 per cent. carbolic acid. The antiseptic was then washed away in boiled water and the wire plunged into gelatin. A luxuriant growth was obtained.

After operating for some time the hands, which were apparently sterile at the beginning, are often found to be seriously contaminated. In discussions on the subject this is usually said to be due to maceration in the fluids of the body and to friction on tissues and instruments. It struck me that this explanation was not sufficient. It might account for the appearance of a number of germs, but it could not account for all of them. The preliminary scrubbing and maceration of the hands would certainly dislodge most of the bacteria capable of being dislodged by these means. It seemed likely that many germs were floated out of the pores by perspiration, which is generally excessive, owing to the heat of the operating-room and the nervous tension of the operator. This hypothesis would also account for the greater number of bacteria which appear upon the hands when rubber gloves are worn.

In order to test the point I made some experiments, in which I assumed that a single finger, with its palmar and dorsal surfaces, its joint creases, and its nail, fairly represented the entire hand from a surgical and bacteriological standpoint. As a culture medium I employed gelatin contained in morphine bottles, each bottle being about two-thirds filled. A finger inserted into such a bottle snugly fits the opening, thus excluding atmospheric contamination. In each experiment the finger was left in the warm, melted gelatin about ten minutes, and continually moved about and rubbed against the bottom and sides of the receptacle, thus stimulating, as far as possible, the friction, maceration, etc., of a veritable operation. The flesh was frequently

pushed away from the nail against the bottom of the bottle, so as to freely admit the gelatin to the subungual space.

Many experiments made to determine the value of methods of cleansing the hands have been rendered valueless by neglecting to remove all traces of the powerful antiseptics employed before immersing the hands in culture media. Very small quantities of an antiseptic, such as bichloride of mercury, are capable of inhibiting germ-growth to a considerable extent. It is not sufficient to rinse the hands in boiled water; chemical means must be employed. Ammonium sulphide answers the purpose well, and it is astonishing to note, when bichloride has been used, after careful rinsing in plain water, how black the fingers will become upon dipping them into the ammonium compound. (The stain can be removed with chloride of lime.)

Experiment 1. Hands scrubbed in warm soap and water, nails cleansed, hands rescrubbed, washed and soaked in alcohol and then in bichloride, rinsed in boiled water, index finger dipped in ammonium sulphide, and then brought into gelatin. About thirty cultures were obtained.

Experiment 2. The hand was then wrapped in sterilized towels and thoroughly perspired for some minutes in a Beck's hot-air oven. Another immersion of the same finger in gelatin furnished about sixty cultures, just double the original quantity, although the same finger being used the number should theoretically have been less.

Experiment 3. The hand was then rescrubbed and resterilized, and the finger again placed in gelatin. But fifteen cultures were obtained.

Experiment 4. The sweating process was again gone through with, following which but two cultures appeared in the nutrient medium.

It was thus demonstrated that, although sweating the hands in this instance doubled the number of micro-organisms, a second sweating failed to bring any more to the surface.

It being quite certain that the finger-nails are the most prolific sources of infection, it occurred to me that by using, in addition to the usual cleansing, a small, rapidly revolving brush attached to a dental engine, I might clean beneath the nails much more effectively than is usually done. It certainly seemed that I could brush the subungual space with the most minute thoroughness; but much to my surprise, I obtained so many colonies in the gelatin that I was practically unable to count them. It seemed that I merely succeeded in loosening up the micro-organisms. On another finger of the same

hand, upon which the revolving brush was not employed, the germs were found to be much fewer in number.

In order to exclude error the experiments were repeated with similar results. Wishing to be certain that some of the cultures did not arise from germs contained in the ammonium sulphide, I poured a little of that compound into gelatin on two separate occasions, with negative results.

I also took occasion to test several processes of sterilizing the hands which are in common use—the chloride of lime method, the mustard method, and the permanganate of potassium and oxalic acid methods. With the two first mentioned I obtained so many colonies throughout the gelatin that I could not count them. This I attribute largely to the fact that I copied fairly accurately the conditions of a surgical operation, by soaking a finger for ten minutes in warm gelatin, rubbing it with force against the sides and bottom of the bottle, and admitting the culture medium freely beneath the nail. Many experimenters, I believe, have contented themselves with simply immersing the hands in nutrient gelatin and perhaps moving them about a bit, which is not sufficient. With the permanganate method between fifty and seventy-five cultures grew; hence this process, according to my experiments, stood next in efficiency to alcohol and bichloride.

Reinicke was unable to render his hands aseptic either by brushing them for fifteen minutes with green soap and hot water or by the use of 5 per cent. carbolic acid, 1 : 1000, bichloride of mercury, sublimate soap, chlorine water, 1 per cent. lysol, tricresol, or sand soap.

Based upon my own experiments and those of others, I feel that the following propositions are approximately correct:

1. None of the methods of sterilizing the hands can be absolutely depended upon. Many positive results are arrived at by means of faulty experimental technique, the culture media becoming impregnated with antiseptics, the skin temporarily hardened by alcohol, formalin, etc., or the hands not subjected to sufficient maceration and friction in the culture medium.

2. Under circumstances where it seems desirable to do so, much may be accomplished by sweating the hands in a hot-air oven, by wearing rubber gloves for some time prior to an operation, or by immersing the gloved hands in hot water. In other words, giving the hands a Turkish bath. Mere prolonged soaking in very hot water, although not so effective as dry, hot air, must have some favorable effect. It

is difficult to understand, however, how the sweating method can dispose of all the micro-organisms beneath the nails. The procedure will hardly be extensively employed, owing to its inconvenience.

3. Excessive brushing beneath the nails, as much even as the sensitive tissues will tolerate, seems merely to stir up the bacteria. We can hope to accomplish little by this means.

4. So far the only really reliable means of rendering the hands aseptic is to incase them in sterilized rubber gloves. But if the gloves become torn, as they often do, the danger of infection is considerable, owing to the bacteria which have accumulated beneath, from perspiration.

5. Coating the hands with various substances has been tried and found ineffectual.

6. Cotton gloves, although they soon become contaminated by exudation from the skin, probably do some good, especially if frequently changed, by filtering out the bacteria, as it were, and preventing their entrance into wounds.

Dr. George Ben Johnston, of Richmond, Va.

It seems to me that the present weakness of surgical operative technique lies in the absence of a germicide which will assuredly and as quickly sterilize the human skin as steam or boiling water will surgical instruments, and until this weakness is repaired the difficulty of perfect surgical technique must remain. For my part I disfavor the use of chemicals in the preparation of the hands, on the ground of an apparent safety to the procedure which is not real. We are obliged to depend upon, first, mechanical cleansing, then upon chemicals, and finally upon artificial covering of the skin of the hands in the performance of surgical operations. Mechanical cleansing constitutes the basis of any further steps in disinfection of the hands. We all recognize this fact. Now, very many operators of inexperience—not those who are operating daily, but those who are operating occasionally—are deficient in the manner of washing the hands. I shall confine my remarks to a method of washing the hands. In the first place, the armamentarium of an operator should be rather elaborate; there should be an abundance of hot sterile water; there should be a number of nail brushes, preferably of wood fibre, and the bristles of these brushes should be sufficiently stiff to penetrate the crevices of the skin, yet not stiff enough to be unkind to the skin. There should be a nail-cleanser, pointed enough to get well under the nail at its free

margin and enter the crevices of the nail about its attachment to the skin. There should be an abundant supply of green soap and of sterilized towels. I maintain that it is impossible to get the the best effect of green soap when the soap is applied upon a wet surface. In order to get out of green soap all there is in it, for the purpose of cleansing the skin, it is well to apply the soap to the dry surface of the skin, finally taking a liberal supply of soap in the palm of one hand and rubbing the palm of the other hand against it until the soap is well distributed over the palms; then apply the soap well to the lines of the hands and forearms, making a very thick smear of soap over the parts that are to be washed, and allow this soap to be rubbed in continually until it practically disappears from sight. This involves much time. Three to five minutes is required for this. In the meantime all the crevices of the skin, all the pores are filled, and what filth is to be found upon the skin in the form of dead epithelium, etc., is incorporated into the soap as a mass. When this is done washing should begin, and it should be systematic, beginning with brush applied to the under surface of the margin of the nail, then around the edge of the margin of the nail, then over the dorsum of the hand, not when the fingers are extended, as I have seen so often, but when the fist is clenched. We should expose every particle of the surface of the dorsum of the fingers; we should get at the wrinkles which are occasioned by the superfluous skin on the back of the knuckles; get down under, make every crevice accessible to the bristles of the brush, and in this way it is supposed the skin can be exposed to proper washing. We should go well into the spaces between the fingers, not promiscuously, but systematically, beginning with the space on the outside, cleaning the little finger and its neighbor, and so on, until every space is taken, first on one hand, then on the other. When this is accomplished the hands are wiped dry on a sterile towel and the skin smeared with soap. This is rubbed until the soap disappears and the skin-washing is gone through with in the same way, and finally the third; and if chemicals are to be used at this juncture, we can apply either permanganate of potassium, dissolved off of oxalic acid, or a solution of bichloride of mercury, or what not. But it is at this juncture that we should use chemicals, if at all.

Personally, as I have said before, I disfavor the use of chemicals, because I believe everything which can be obtained by our present imperfect methods can be gotten by green soap, proper brushes, and an abundance of sterile water, and without use of chemicals. I think

chemicals are misleading, and too much reliance is placed upon them by assistants, and they are expected to do what they cannot do. The hands may not be capable of this rough usage. It seems to me the hands of the man who is operating daily for a number of hours should receive some attention outside of operative work, because the skin soon gives way unless it is kindly treated during the intervals between operations. It is my practice nightly, before retiring, to give the skin of the hands some little attention. I wash them in warm water and soap. Any good plain soap will suffice. Having gotten them reasonably soft and pliant, they are dried and an emollient is used, preferably one made of gelatinous material dissolved in a solution of boric acid to which glycerin has been added. This is allowed to dry on the hands and renders the skin soft and pliant. It protects the skin to some extent. After a few such applications the skin will tolerate any amount of scrubbing, otherwise, especially in winter time, frequent washings of the hands with a strong stiff brush with hot water produce fissures and chaps, and it takes a man of great fortitude to give the hands sufficient washing when they are in a state of irritation or inflammation, either from chaps or from the use of chemicals. It is important, then, that the hands should receive some attention outside of the operating-room. Any roughness about the nails should be well trimmed down, and when a slight abrasion occurs it should be properly cared for by protecting it with a bit of adhesive plaster or flexible collodion between operations.

There can be nothing added practically to the very valuable paper we have heard this morning by Prof. Kocher, and nothing to what Dr. Freeman has already said. I simply wish to emphasize the statement which I have made in advance, that until we have at our command a chemical which will quickly and thoroughly disinfect the hands we are obliged to depend upon mechanical cleansing, and this can only be done by the use of an abundant supply of hot water, soap, and clean brushes.

Dr. Duncan Eve, of Nashville, Tenn.

I regret, Mr. President, that I was not here during the reading of the paper. I only heard the last portion of it, and I cannot discuss it as intelligently as I might do had I heard it all. However, the most effective and, therefore, most important means of disinfection of the surgeon's hands is the mechanical method, which may be said to be two-thirds asepsis. It is impossible to entirely disinfect the hands or

surface of the skin, from the fact that infection is found in the deeper or granular surfaces of the skin beyond the reach of the brush, however well applied, or even the action of the most powerful antiseptic. If the hands be cleansed, and then the so-called sterilizing antiseptic washes, such as carbolic acid, permanganate of potassium, bichloride of mercury, applied, no doubt the surface of the skin is in an aseptic condition. Should the hands under these conditions be brought in contact with a culture medium no growth would occur; but after a certain length of time elapses and the hands are used, as they usually are in ordinary operations, the deeper lying germs are worked toward the surface and the hands again become septic. The recently employed use of carbolic acid as a wash for the entire surface of the hands and forearms, practised after the mechanical method has been gone through with, and then to wash off the carbolic acid with alcohol, which seems to act as an antidote, or prevents the escharotic effect of the acid, presents, to our mind, the best of all antiseptic plans of disinfection of the hands. I will state in this connection that you would be surprised to notice the slight anæsthetic effect after the use of carbolic acid. At first one would seem to be prejudiced, knowing what a severe effect it has when locally employed. I had occasion not long since to amputate the finger of a student, where carbolic acid had been applied quite liberally on a dissecting wound, and yet I have not the least doubt that if its antidote (alcohol) had been applied, or the part washed off with alcohol, no cauterizing effect of the acid would have been noticed. It has been said that disinfection of the hands does not depend upon one or another plan, but is an art *per se*, and must be learned as such. The modern surgeon will disinfect his hands more thoroughly in one minute than a less experienced surgeon will do in fifteen minutes. Notwithstanding the great progress that has been made in recent years our means of disinfection are still far from being perfect, and our main reliance is in prophylactic measures. Bacteriological researches have done little or nothing toward perfecting this plan, and the ordinary disinfectants when used cannot be regarded as the *sine qua non* of thorough sterilization or disinfection of the hands. The method I suggest must be learned in a manner requiring much time and great patience.

DR. ROSWELL PARK, of Buffalo, N. Y.

I have nothing special to say except that I have not forgotten a remark once made by one of our Fellows in Washington in a discus-

sion before the Congress a number of years ago, to the effect that every operation was a bacteriological experiment. There is no reason to-day to modify that statement in the slightest. I do not think we have reached an ideal method for disinfecting the hands, nor do I believe we shall until we are able to pass them through flame. But for my own purposes, I would like to say that I never found anything better than mustard, which I introduced a number of years ago, and I have as much faith in it now as I ever had. It is my belief that it is one of the best of the antiseptics which one can use, and I think so partly for the reason that it enhances tactile sensibility rather than injures it. Tactile sensibility is much exalted by the use of mustard, but this is not so when the hands are submerged in carbolic acid or any other agent used for purposes of disinfection. Mustard does not leave the hands in an uncomfortable condition afterward, and it disinfects them as well as anything that has come under my notice.

Dr. W. W. Keen, of Philadelphia.

There is one peculiarity in this paper, and that is, Prof. Kocher includes every operation, I believe, done from the 1st of October last until the time the paper was written. If a contribution of that character could be made by the Fellows of this Association it would be extremely valuable, and would go far to settle, by the experience of representative men from all parts of the country, the actual value of the different methods of disinfection which are practised by the members of the Association. Certainly a method which gives such extraordinarily good results as has been shown by the table of Prof. Kocher is not one that should be passed by lightly by this Association, and its simplicity as well as its efficacy commends itself to us in the highest degree.

Dr. Willard, of Philadelphia.

Prof. Kocher has wisely emphasized the importance of scrupulous care of the surgeon's hands throughout the entire twenty-four hours of each day, not only in the avoidance of sources of infection, but also in the prevention of excoriations and abrasions. During the active operative period of winter I apply an emollient each night.

NEPHRECTOMY VERSUS NEPHROTOMY.

BY JOSEPH RANSOHOFF, M.D., F.R.C.S.,
CINCINNATI.

RENAL surgery is essentially the product of the past twenty years. The occasional operations on the kidney performed before that, paved the way for a clearer appreciation of the conditions demanding operative relief. Betterments in the modes of examination, and the consequently greater accuracy in diagnosis, the recognition of the early gross changes wrought by disease, as seen by operation rather than by autopsy, and the comparative safety of incisions through healthy kidney tissue have brought to the fore the element of safe conservatism in the domain of renal surgery. Indiscriminate removal of the kidney has given way in properly selected cases to sparing measures, as amputations have been largely supplanted by less mutilating operations on the extremities.

When your committee honored me with the request to present the subject, "Nephrectomy versus Nephrotomy," they wisely limited its scope. Seemingly the entire class of renal neoplasms is *a priori* excluded from consideration. Nevertheless, I desire to present the following case, for its rarity and the lesson it preaches for early interference.

R. M. A., aged forty-seven years, admitted to Jewish Hospital October 14, 1898. Family history negative; has had the ordinary diseases of childhood. For the past fifteen years has suffered occasionally from pains in the right side, which often continued two or three days. During the past fifteen years his urine has, for the most time, been very cloudy; has never had any blood in the urine. Seven years ago the patient had what

was called a bilious fever, associated with severe pain in the region of the gall-bladder. About three years ago he had a similar attack which lasted about nine months. With the exception of passing very cloudy urine, the patient seemed well until last July, when the present illness began with very severe pain in the right side and the development of fever. He has gradually grown worse since, notwithstanding internal medication; has lost about thirty pounds in weight. The pain is now continuous, heavy, and dull.

Physical Examination. General emaciation; heart and lungs normal; liver and spleen normal. In the right side of the abdomen is found a large swelling, distinct fluctuation in the loin, and dulness as far forward as the right semilunar line. Downward the swelling extends to near the crest of the ilium. The tumor presents no distinct nodules, and is firmly fixed; œdema of skin in costo-iliac interval.

Temperature in the evening, 103°; pulse varies from 108 to 120°; urine passed in twenty-four hours, 480 c.c.; color, light; reaction, acid, large amount of albumin present, sediment profuse; pus cells numerous; few red disks; no tubercle bacilli found.

Diagnosis. Calculous pyonephrosis and perinephric abscess.

Operation October 18; chloroform anæsthesia. An oblique incision, four inches long, over the most prominent part of the swelling posteriorly. Before the kidney was reached a large abscess was opened, and vent given to nearly a pint of very fetid pus. An incision into the kidney was made, but owing to the condition of the patient an extensive exploration was not deemed permissible. The sacculated condition of the organ was established; drainage by large tube. During the first twenty-four hours after the operation the patient passed 480 c.c. containing blood and pus cells.

From this operation the case seemingly progressed toward recovery for six or eight weeks. The tumor subsided considerably. The temperature had returned to normal, and the pain had entirely disappeared. On December 28, 1898, the patient re-entered the hospital with a return of the symptoms. His

emaciation has progressed, and vomiting was added to the other symptoms. The temperature was 101½° in the evening, with pulse varying from 100 to 120. The tumor in the loin now presented in distinct nodules, which aroused strong suspicions of a secondary neoplasm. Dr. C. A. L. Reed saw the case in consultation. Fully appreciating the gravity of the condition, the patient submitted to a second operation January 2, 1899. Incision along the line of the old scar prolonged toward the iliac crest. After exposure of the kidney and the fistulous opening remaining at the first operation, the finger inserted through this opening detected a very large stone filling the pelvis. About it were large soft masses of malignant tumor. On exposing the kidney the involvement of the pararenal tissues by the malignant process was established. The adhesions of the growth to contiguous parts were so dense that in the condition of the patient an extirpation would have been immediately fatal. With drainage established the wound was closed. This operation was an incomplete one, and the patient succumbed forty-eight hours after the operation to shock and hemorrhage.

While the diagnosis of pyonephrosis was made, and its calculous origin suspected, the presence of neoplasm was not seriously considered until shortly before the second operation. The size of the stone confirmed the view that nephrolithiasis and pyelitis had been present for many years. When the malignant disease supervened it is impossible to state. From the rapid failure in health during the past twelve months it is reasonable to infer that its growth did not antedate that period. While enough cases of renal calculus associated with carcinoma have been recorded to establish an etiological relationship, I have found only few other cases in which pyelonephrosis was operated for and carcinoma with calculus found.

Hydronephrosis.—Of the purely mechanical distentions of the kidney with aseptic contents, three cases have come under my observation for operation:

Mrs. A. L., referred by Dr. Adams, admitted to the Jewish Hospital October 2, 1891, aged forty-two years, mother of four

children. Since her second confinement has had pain in the right loin, often of a colicky nature; tumor discovered in the abdomen about a year ago; patient states that it varies in size and some in position; with decrease of tumor blood has been found in the urine on three occasions.

Present Condition. Well-nourished woman; menstruates regularly; lungs and heart normal; urine normal in amount, but contains a few leucocytes and epithelial cells. In the right lumbar region a tumor the size of a fœtal head can readily be made out. It can readily be displaced into the loin. Ballottement very marked.

Diagnosis. Movable hydronephrotic kidney, with suspicion of stone.

Operation October 14, 1891. Lumbar nephropexy by oblique incision. When the kidney was exposed it was aspirated, and a little over one-half pint of clear, very light colored fluid was removed. Suspecting a stone an incision was made into the sac. No stone was found. Flattening of the pyramids was quite marked. An effort to catheterize the ureter failed. The nephrotomy wound was left open, but not drained. The kidney was anchored by its capsule to the muscles and fascia. The wound was closed except over the wound in the kidney, where it was drained. The recovery of this patient was uneventful, except for a urinary fistula which discharged less and less for about two months, when permanent closure took place.

Of traumatic hydronephrosis I have seen but one case, with Dr. W. F. Taylor. It occurred in a robust man, aged thirty-five years, who sustained a severe fall, producing fracture of the left lower ribs. During forty-eight hours after the injury the urine contained considerable blood, often clotted. Within three weeks a fluctuating swelling developed with all the physical signs of hydronephrosis. The writer saw the patient two months after the injury. Aspiration had already been performed twice. These aspirations were repeated at gradually lengthening intervals, and eventuated, I have been informed, in a permanent cure. Quite recently the writer saw, with Dr. H. W. Bettmann, a case of hydronephrosis without discernible

cause. Thirteen aspirations had been done, mostly transperitoneal. As much as four quarts of fluid were often removed at a time. The patient was able to follow his vocation, and, therefore, refused any more radical interference.

If it should come to a question of nephrectomy the difficulty would be obviously enhanced by the transperitoneal tappings which had been performed. In all the cases when transperitoneal nephrotomy has been done the secondary nephrectomies were most difficult. In the treatment of hydronephrosis by lumbar nephrotomy I have had but one experience. It was in a woman, aged forty-three years. The cause for the condition could not be detected. A fistula continued to discharge during a number of years without influencing the patient's health. An effort to look her up recently failed.

In only one case of hydronephrosis have I had occasion to perform nephrectomy. The case was that of a man, aged twenty-seven years, referred to me by Dr. Stewart. The tumor had developed fifteen years, and probably was of congenital origin. It had been aspirated many times. On several occasions syncope supervened while the fluid was being drawn off. It was not unusual for a gallon to be drawn off at a tapping.

Operation. Jewish Hospital, November 3, 1898. Nephrectomy by incision in Langenbuch's line. From numerous punctures the fasciæ surrounding the sac were densely adherent. The dissection was most tedious and difficult. Very free oozing attended the operation throughout. After the exposure of the antero-lateral surface of the cyst it was tapped and the sac brought into the wound. To save time the pedicle was clamped. As it was, the operation lasted two hours. Exitus thirty-six hours after operation from shock and hemorrhage.

Hydronephrosis is a condition due to the obstruction of the outflow of the renal excretion. Therefore, since Kuester, in 1891, showed his first successful operation on the ureter for the relief of hydronephrosis, efforts have been made whenever feasible to remove the cause. Notable in this connection is the work of Fenger presented to the Association in 1894. Twelve operations have been performed with two deaths. One from

intestinal obstruction (Trendelenburg), and one from anuria, due to bilateral disease. In two of the cases (Van Hook and Morris) nephrectomy had finally to be practiced. When an operation is indicated for hydronephrosis, choice must usually be made between incision and extirpation of the sac. Considering the tendency to involvement of both kidneys, nephrotomy should, I think, be considered the normal procedure until some simple and safe aid shall be devised to assure us of the sanity of the other kidney. According to Morris's statistics of acquired hydronephrosis, 36 were unilateral and 106 bilateral. According to the larger tabulation of Newman, of 665 cases of acquired disease it was unilateral in 217; bilateral in 448. In the congenital cases the proportion of bilateral involvement is about the same. Nephrotomy is not a dangerous operation. According to White,[2] of eighteen done for hydronephrosis by different operators none proved fatal. According to Freitag[3] recovery follows incision in 30 per cent. of the cases without fistula. When considerable renal parenchyma is preserved tentative nephrotomy is indicated, to be followed after a short time by secondary nephrectomy for the relief of the fistula, if a plastic operation on the pelvis of ureter is not feasible or has failed. For the relief of very large hydronephrotic sacs in which the remnant of kidney tissue has lost its function, primany nephrectomy should be made, provided the other kidney is normal. This is almost always the case when there is a hydronephrosis of large size and many years' duration. The nephrectomy is here reduced to the enucleation of a thin fibrous sac.

Acute Suppuration of the Kidney. The kidneys being among the emunctories for the elimination of septic material from the blood, it is remarkable that suppurative processes in them are not oftener found in the wake of acute infections. When they do occur they are often masked by other manifestations of a grave infection. This is generally bilateral, although unilateral involvement is far from rare. The abscesses are multiple and in the cortex. The cases which would be proper for operation are necessarily few, yet four have come under my care:

Case I. Joseph L., aged nineteen years, seen with Dr. Eich-

berg. Patient had gone through a typical typhoid fever of three weeks' duration without complication. Remained without fever during three weeks, when a chill supervened, and was followed by a continuous fever with morning remissions. Severe pain in the left loin. No symptoms on part of urine. I saw the patient two weeks later, when a marked enlargement of the kidney could be made out. The urine was free of pus throughout. Operation June 14, 1892, under chloroform anæsthesia. The left kidney was exposed by lumbar incision. Perirenal fat markedly œdematous. When the kidney was exposed two fluctuating areas were felt in the convexity, one near the upper pole, the other near the centre of the gland. Both were incised. The abscesses did not communicate with the pelvis. This patient recovered rapidly, although for a year a uro-purulent fistula continued to discharge slightly. There has been no relapse, and the patient continues in perfect health.

CASE II. Mr. M. F., aged thirty-nine years, clerk. History of gonorrhœa four years ago. Acute course without complications. Was well until four weeks before admission to hospital, when the present illness began with severe pains in the back and left side of abdomen, dysuria and fever. Has had one severe chill. He never had a similar attack.

Present State. Well-nourished male. Thoracic viscera normal. On the left side an enlargement of the kidney can readily be made out. Indistinct fluctuation elicited by bimanual examination. Tumor seems to descend on deep inspiration.

Urinalysis. Urine always acid; contains pus; no red blood-cells; tubercle bacilli absent. Operation, Jewish Hospital, August 3, 1890. Nephrotomy by oblique lumbar incision. About one-half pint of very fetid pus evacuated. Kidney very much lobulated. No stone was found. Drainage with rubber tube. During three weeks most of the urine was discharged through the drain. In a change of dressing the tube was accidentally removed, and could not be replaced. Recurrence of fever. September 3, wound partly opened and metallic tube inserted. November 11, 1890, patient discharged from the hospital with a uro-purulent fistula. I have since learned that a

part of the tube had to be removed after the patient left the hospital. A few years ago I heard from the patient. He continues well without a fistula.

CASE III. Mrs. F. J., aged twenty-nine years, seen with Dr. Palmer, in October, 1886. Mother of two children. Has suffered much from the bladder since her last confinement. Was about her work until a month ago, when she began to have severe abdominal pains, and observed a swelling in the lower abdomen to the right of the umbilicus. During three weeks has had more or less continuous fever and several chills.

Present Condition. General condition profoundly septic. Dysuria very marked. Urine loaded with pus. Quantity could not be measured. In the right side of the abdomen, extending from below lower border of the liver to the crest of the ilium, there is a fluctuating tumor, very sensitive to touch. It was the size of a double fist. Tumor fixed in position. Vaginal examination negative.

Operation. Incision in linea semilunaris. Tumor, when exposed, proved to be a malplaced suppurating kidney. Transperitoneal nephrotomy was therefore done. The operation did not relieve the septic condition, to which the patient succumbed nine days after the operation.

A fourth case of acute suppuration which involved both kidneys has been elsewhere reported. On one side a small calculus was removed by nephrotomy from a suppurating kidney, The symptoms were of three weeks' duration. Four weeks later the other kidney developed an abscess, in consequence of which total anuria supervened. Nephrotomy was performed, and vent given to an ounce of very fetid pus. This patient has recovered, except for a bilateral renal fistula. Practically no urine has entered the bladder in five years. The patient is in excellent health, and has persistently refused all operative measures for the relief of his fistula. The right kidney secretes less than one-fourth of the total amount of urine.

I have here presented four cases of acute suppuration of the kidney, saved by nephrotomy. In the last case a nephrectomy on the side first operated upon would certainly have been followed

by death. Although it contained a stone, this kidney excretes twice as much as its fellow that was secondarily involved. In the one case in which nephrectomy was performed no other procedure was practicable, owing to the fixed position of the gland in an abnormal position. The general sepsis was so marked that a nephrotomy, if it had been feasible, would not have averted death. In acute abscess and pyelonephritis, nephrotomy should, I think, be considered as a routine procedure. The frequency with which these acute processes are bilateral militates against nephrectomy. The case above reported is not unique. Lilienthal recently saved a patient by nephrotomy on each kidney, multiple abscesses being opened by the operation. The condition of these patients is usually such that the necessary examinations, cystoscopic or otherwise, to determine the condition of the other kidney, cannot be made. This applies equally to the true pyelonephrotic or surgical kidney. Here nephrotomy appears to me likewise to be a procedure preferable to incision, as originally advocated by Weir in 1894[4]. In Weir's case the kidney contained many miliary abscesses and hemorrhages, and was beyond salvation at the time of operation.

The cases cited appear to me to plead forcibly for the early operation in suppurative diseases of the kidney. Besides giving vent to pus, the nephrotomy, by relieving tension, limits the disease and insures, as far as possible, the salvation of the viscus. It is applying to the kidney the surgical principles that guide our treatment in other inflammatory processes confined within unyielding membranes, like the periosteum or the fasciæ of the neck. In this connection it may not be amiss to refer to the admirable suggestion of Reginald Harrison, of extending the field of nephrotomy to non-suppurative cases. In three cases of acute albuminuria the operation was followed by success.

In a recent contribution Oscar Block,[5] of Copenhagen, advocates nephrotomy for diagnostic purposes in diseases of the kidney that are not strictly surgical. He removes a small portion of the organ for microscopical examination. In three of his

cases he demonstrated that there was not a neoplasm, but a parenchymatous nephritis. When a nephrotomy is indicated the excision of a portion of the gland for examination cannot add to the danger of the operation. Except in this regard the operation ought not, in my judgment, to be advocated.

Chronic Pyonephrosis. In contrast with the acute suppurations of the kidney tissue and pelvis hitherto considered are those which from the beginning display a tendency to a more or less chronic course. Whether the result of a renal calculus, or of an ascending infection from the bladder, or from causes beyond our knowledge, many months and often years are allowed to pass before surgical relief is sought. In the consideration of the subject, "Nephrectomy *vs.* Nephrotomy," I have deemed it wise to consider these cases as distinct from those of acute type. These cases, as a rule, do not present emergencies for immediate relief, and they can, therefore, be better studied in regard to the functional equivalent of the other kidney preliminary to nephrectomy. Furthermore, the more chronic the disease demanding an operation the more favorable the prognosis, since under these circumstances the sister gland has probably developed a double functional capacity. Of chronic pyonephrosis I have had but two cases, both of calculous origin.

Case I. Good Samaritan Hospital, September 20, 1894. Mrs. W., aged forty-three years, married. About seven years ago patient was sick with acute renal pains, followed by discharge of pus and blood with the urine. Since the first these attacks were invariably limited to the left side. The present attack, like previous ones, began suddenly with the sense of weight and fulness and the detection of a swelling.

Present Condition. Fairly nourished woman. Temperature in the morning, normal; in the evening, 100°; pulse varying between 80 and 100. On the left side the kidney, enlarged to the size of a doubled fist can be clearly outlined in its lower segment. It presents itself as a rather movable tumor in the costo-iliac interval, not reaching the iliac crest.

Urinalysis. Urine, often examined, is turbid, light in color, and containing a sediment rich in pus cells and crystals of oxa-

late of lime. A few red blood-disks in every specimen. Very many examinations failed to reveal the bacillus of tuberculosis.

Diagnosis. Movable kidney, with recurring pyonephrosis, probably of calculous origin. Right kidney determined to be normal by cystoscopic examination.

Operation, September 28; chloroform-morphine narcosis. Incision parallel to last rib. Exposure and fixation of kidney. Removal by incision of about a pint of fetid pus. Kidney sacculated. In lower portion an adherent calculus was found and removed with some difficulty. Irrigation and drainage. The patient's temperature varied from 101 to 102.5° from the third day for a week. Profuse discharge necessitated daily dressing.

November 27. Patient discharged in good condition, with renal fistula and drainage-tube. During two and one-half years following nephrotomy the patient continued in fair health. Occasionally with a closure of the fistula she suffered severely until drainage was re-established.

May 6, 1896. Re-entered Good Samaritan Hospital. Secondary nephrectomy. Oblique lumbar incision. Kidney small and contracted. Perirenal adhesions very firm. Enucleation difficult.

Left hospital May 30 with slight fistula which closed after a few months. Patient now in perfect health.

CASE II. P. J. P., male, aged forty-two years. Entered Good Samaritan Hospital October 31, 1898. Referred by Dr. Whittaker. Family history negative. Since his eighteenth year, when he was injured in region of kidney, had occasional attacks of pain, of colicky character, followed by vesical irritation and frequent urination with bloody urine. Passed two small calculi a year ago. Urine has contained pus for three years. Has gradually become weak, having lost twenty pounds.

Present State. Patient is weak and emaciated. Lies in bed most of the time. Voice feeble and husky. Temperature ranges from 99½° in the morning to 102° in the evening. Passes urine twenty times or more a day. Pain complained over kidney and ureter. Urine is normal in quantity, turbid and muddy. Reaction neutral or faintly acid. Microscopic

examination : Pus cells in large numbers ; pus casts ; small granular casts ; tailed cells. No crystals found. Examination as to tubercle bacilli negative. X-ray examination negative.

Diagnosis. Pyonephrosis of calculous origin. Nephrectomy by oblique lumbar incision, November 14, 1898. Kidney found converted into thin-walled pus sac. Little kidney tissue left. Two smooth urate stones varying in size were found. One weighed 129 and the other 32 grains. Patient made slow recovery, and left hospital with a fistula, which required dressing every few days. Has since regained his best weight. From the time of operation the quantity of urine approached the normal, the remaining kidney having doubtless long performed double duty.

There are few problems in surgery concerning which, when there are only two solutions possible, opinions have varied so much as on the choice between nephrectomy and nephrotomy in pyonephrosis.

Nephrotomy *per se* is doubtless an operation nearly devoid of danger. When performed on a healthy kidney, as for stone, the mortality is less than 5 per cent. When performed for suppurative diseases the mortality rises. I have tabulated records of seventy-eight nephrotomies for pyonephrosis, exclusive of tuberculosis, published within the last three years, from various clinics ; from Lotheisen, Morris, Thornton, White, Israel, Wagner, Hildebrandt, Johnston, and a few contributions of individual case-reports. Of these seventy-eight nephrotomies seventeen were followed by death. Mortality, 21.8 per cent. In the hands of some surgeons the mortality has been very large. Four out of five cases were fatal in the Vienna clinic. Out of six cases of nephrotomies at the Roosevelt Hospital three died. On the other hand, Israel lost only one out of eight, and Thornton one out of twelve. From the same sources I have tabulated thirty-seven primary nephrectomies with nine deaths, giving a mortality of 24.3 per cent., and seventeen secondary nephrectomies with seven recoveries and ten deaths, a mortality of of 58.8-10 per cent. Here, again, the admirable results of Israel, of fourteen nephrectomies, with one death, head the list of suc-

cesses. A cursory glance at these statistics would indicate that the champions of conservatism in the treatment of pyonephrosis, among whom Wagner and Kuester deserve prominent mention, had the advantage of statistics. The mortality, 21 per cent., however, is the immediate post-operative mortality. There is no way by which the latter death-rate can be established. In regard to the end-results after nephrectomy the doubt does not obtain to the same extent, although in a number of cases recorded nephrotomy on the remaining kidney had to be performed. The most striking feature of these statistics is the very high mortality of the secondary nephrectomies. In hands so skilled as those of Israel[6] the mortality reached 60 per cent. Statistics appear to prove the falseness of the belief hitherto entertained that secondary nephrectomy is a less dangerous procedure than the primary operation. According to Gross[7] the mortality of removal of the kidney for suppurative disease is nearly twice as great as after nephrotomy, and a preliminary nephrotomy diminishes the risk of nephrectomy by more than 40 per cent. The change that has been wrought in favor of the latter is in a large measure due to improvements in the operative technique and the increasing readiness on the part of the patients for earlier interference.

The advantages of nephrotomy for pyonephrosis are obvious: (1) it is an operation readily tolerated even in patients greatly reduced by fever; (2) it permits one to determine the condition of the opposite kidney; (3) by it the saving of even a small amount of functionating kidney tissue may throw the balance in favor of recovery. In regard to the second advantage it is of least value. Unless there is occlusion of the ureter, the nephrotomy will rarely prevent the flow of some of the excretion of the kidney into the bladder, so that auxiliary means of establishing the condition of the other kidney must still be resorted to. Pinner[8] has recently made the suggestion of tamponing the upper end of the ureter through the nephrotomy wound with a catheter for a few days, thus gaining, for the time being, the secretion alone of the opposite kidney.

Nephrotomy often fails to relieve the septic absorption, ex-

cept temporarily, because of the inadequacy of the incision as it is ordinarily made. In moderate distention of the kidney the lobulation retains the original form of the common pelvis with distended pouches for the upper and lower poles. Drainage of one cavity cannot be long maintained through an opening in the other. Two separate incisions through the cortex are required, or one long one. To this extensive incision with fixation of the two halves of the renal tissue to the anterior and posterior lips of the parietal wound, Guyon and Albarran[9] have recently applied the term nephrostomy. If by its use the importance of a free incision and ample drainage were emphasized the term would merit a place in the nomenclature of operations.

In dealing surgically with a pyonephrotic kidney statistics can guide the operator only in a general way in the choice between nephrectomy and nephrotomy. A routine recourse to one or other operation is thoroughly unsurgical. It is here that each individual case must be treated on its merits. Above all things, it is unsurgical to make the nephrotomy the normal operation with the view that if it fails, a secondary nephrectomy may at any time be done. The patient with a uro-purulent fistula, feeling fairly comfortable or declining slowly in health, cannot easily be persuaded to a second operation until too late to be successfully accomplished. The presence of an imperfectly drained suppurating kidney is of itself a menace to its congener, either by way of the circulation or by an ascending infection. While it is impossible to lay down positive indications for the one or other operation, I feel warranted in submitting the following propositions, from my experience in renal surgery, and more from a fairly extensive study of the pertinent literature:

Nephrotomy is indicated in pyonephrosis, (1) when the condition of the opposite kidney cannot be ascertained; (2) when the reduced condition of the patient will not permit the major operation if this is indicated: the nephrotomy is then but the preliminary step to be followed by nephrectomy as speedily as possible; (3) when the operation reveals the pres-

ence of considerable kidney tissue, and an approach to the normal on the part of the pelvis and proximal portion of the ureter; here a later ureteroplasty may divert the need of nephrotomy; (4) when there is evident suspicion of disease in the other kidney.

Primary nephrectomy is indicated, (1) when there is a sound second kidney; (2) when inspection of the exposed kidney shows many or large pouches that cannot be successfully drained; (3) when there is little kidney tissue left; (4) when an examination of the pelvis and proximal portion of the ureter makes it reasonably certain that a return to the normal cannot take place; (5) in paranephric and perinephric suppurations where the kidney acts as a valve impeding successful drainage. [Israel.]

Renal Tuberculosis. Of tuberculosis of the kidney seven cases have come under my observation. With one exception I believe them to have been of primarily renal origin.

Case I. Mrs. P., aged fifty-seven years, married. Referred by Dr. Ravogli. Admitted to Good Samaritan Hospital June 15, 1893. Patient states that she has had pain in the left kidney for two years. Micturition has long been more frequent than normal. Urine has frequently contained blood. Has had many attacks of nausea and vomiting. Prior to admission to the hospital five ounces of pus were removed by aspiration. Has had some cough.

Present State. Patient in hectic state. Is greatly emaciated. Urine turbid and flocculent; acid reaction when passed; pale in color; sp. gr. 1010; tubercle bacilli found by sedimentation. Slight dulness over left apex; expectoration. Left kidney palpably enlarged and moderately painful.

Diagnosis. Renal tuberculosis. Operation June 17, 1893. Oblique lumbar incision. About six ounces of flocculent pus were removed from kidney by long incision. No stone found. Drainage by large rubber tube. External wound partly closed.

Subsequent History. Patient recovered from operation, and after ten days was enabled to leave her bed. A uro-purulent fistula continued to discharge up to the time of her death, four

months after the operation. Her end was hastened by intestinal tuberculosis.

CASE II. R. R. S., male, aged forty-six years, Jamestown, Ohio. Admitted to Jewish Hospital October 24, 1893. Father died of old age. Mother living. Some history of tuberculosis on father's side. He had no illness except typhoid fever ten years ago. Present illness began in January, 1892, with pain in back and frequency of micturition. Has had a number of colicky attacks, but none severe enough to confine him to bed. During the last six months has emaciated rapidly. Urine always contains copious sediment. Has had four or five severe chills.

Present State. Very much emaciated. Confined to bed most of the time. Temperature observed during four days before operation ranged between 99° in the morning and 102° in the evening. The urine varies from 32 to 48 ounces. Light in color, acid, always contained abundant sediment. Tubercle bacilli found by Dr. Evans. Cystoscopy showed bladder normal, except for abnormal injection of the bas-fond. Ureteral orifices could not be clearly seen. But one examination was made, the condition of the patient not permitting further exploration. Lower pole of left kidney readily palpable through thin abdominal wall. It is very tender and enlarged. Right kidney not sensitive.

Diagnosis. Renal tuberculosis. Consent was given for nephrotomy only. Operation October 29, 1893. Oblique lumbar incision. Kidney exposed and incised. Vent given to about three ounces of flocculent, non-fetid pus. With the finger a number of lobules were emptied of their cheesy contents. No stone was found. Fixation of kidney in wound and drainage.

Subsequent History. Patient recovered from operation, and was discharged from hospital December 22, with active, discharging fistula. Death seven months after operation from unknown cause.

CASE III. Mrs. B., aged twenty-eight years, seen with Drs. Johnson and Dunham. Family history negative. In childhood had tubercular arthritis of the knee. Anchylosis in faulty

position. Nine months after confinement commenced to complain of great dysuria. During three months the symptoms indicated disease of the bladder, for which irrigation had been practised by her first physician. About three months after inception of symptoms pain began in the region of the left kidney. Associated therewith was a temperature never falling below 102° and often rising to 103° or over in the evening. Urinalysis by Dr. Dunham revealed a great variety of pus-formers and tubercle bacilli in large numbers. Left kidney palpably enlarged. Fluctuation very distinct.

Diagnosis. Pyonephrosis of tubercular origin. Operation by Dr. Johnston. Oblique incision. Vent given to six or eight ounces of cheesy pus. Kidney very much sacculated. Patient not in condition to bear nephrectomy. Tubular drainage.

Subsequent History. Patient recovered slowly from operation, with fistula which still requires two or three dressings daily. Has since developed pulmonary tuberculosis. Exitus a question of short time.

Case IV. B. A., aged twenty-seven years. Admitted to Jewish Hospital May 30, 1897. Family history negative. Patient had grip four years ago. About a year before admission had a severe attack of pain in region of right kidney, which radiated toward inner aspect of thigh. Morphine necessary to relieve pain. Attack followed by nausea and vomiting. Had had many similar attacks since, the intervals becoming shorter. He is now rarely free from pain in the back. Has never passed any gravel. Has lost thirteen pounds since illness began.

Physical Examination. Poorly developed male, with facial expression of great suffering. Chest normal. Pressure on left kidney always very painful. Pain most marked just below centre of last rib. No swelling preceptible. Urinalysis indicated pyuria of renal origin. Never any crystals. Always a few red blood-cells. Negative as to tuberculosis. Two cystoscopic examinations were made, but were negative as to everything except the condition of the bladder. This was normal.

Diagnosis. Nephrolithiasis.

Operation, April 30, 1897. chloroform anæsthesia. Oblique incision. Perirenal fat scant, but dense. Kidney, when brought into wound, showed a depressed indurated area, seemingly cicatricial, over posterior surface. When this was incised a cheesy, fatty débris escaped, and a cavity as large as a hickory-nut exposed. This was thoroughly cleaned out with gauze. The walls of the cavity were quite rough, and bled profusely. The connection with the infundibulum could not be demonstrated. So sure was I of the existence of a stone that the kidney was split along the convexity for exploration of pelvis and ureter. A stone was not found. The kidney was sutured and anchored in position. The abscess cavity was packed with iodoform gauze. The patient recovered slowly, but was discharged from the hospital, without fistula, June 6, 1897. He was still having occasional attacks of pain. When preparing this paper I wrote to the patient as to his present condition. He is perfectly well, but passed a small "gravel" eight months after leaving the hospital. This was certainly overlooked at the operation. The cheesy deposit in the kidney was quiescent and accidentally discovered. I believe it to have been a quiescent tubercular process.

Case V.—F. N., aged thirty-two years, male. Referred by Dr. Greiwe. Family history of tuberculosis well marked. Has been well until about seven months ago, when he began to feel indistinct pains in the lower dorsal region, most marked on right side. Began steadily to lose flesh, until he is now about thirty pounds below his normal weight. Has in the past two months suffered from frequency of micturition and indistinct pains about the lower abdomen. Urine has been turbid for many months. After an exposure to a drenching rain, began to have exacerbation of symptoms. Fever likewise developed.

Present Condition. Poorly-nourished man, of hectic appearance. Temperature ranging between 101° and 103½°. Confined to bed most of the time. Thoracic viscera normal, except for slight dulness over left apex. Right kidney distinctly enlarged and very painful to pressure. No evidence of genital tuberculosis. Urinalysis by Dr. Greiwe: Urine turbid and flocculent,

of pale color and acid. Specific gravity usually about 1012. Quantity passed within twenty-four hours slightly above the normal. Tubercle bacilli found in almost every specimen.

Diagnosis. Primary tuberculosis of the right kidney.

Operation, 1896. Patient's condition and surroundings precluded the use of the cystoscope. A preliminary nephrotomy was advised. Oblique lumbar incision. Kidney incised along convexity. Vent given to three or four ounces of thick flocculent pus. Irrigation of cavity with salt solution and drainage.

Subsequent History. Patient rallied from operation, and was about the house within a week. Urine thereafter was at many times clear. Consent for nephrectomy could not be obtained. Patient died eight months after from exhaustion. The pulmonary tuberculosis became more active, and was the immediate cause of the fatal issue.

CASE VI. Mrs. L. W., aged thirty-three years, Hamilton, Ohio. Admitted to Jewish Hospital November 24, 1896. Married seven years. Has never been pregnant. Began menstruating at eighteen. Has menstruated regularly until four months ago, since which time there has been no flow. Two years ago noticed increased desire to urinate, particularly at night. No pain nor cloudiness of urine. Gradually became weaker, and at times was hardly able to walk. Pain began a little over a year ago, most marked at end of urinating. Urine contained large sediment in which shreds were noticed. Pain in the back, particularly at this time, became severe. Has never passed blood. During two months has been treated by vesical irrigation without much relief.

Present State. Patient much reduced. Temperature ranging from 101° to 103°, very irregular in course. Great tenderness in left kidney. Easily felt to be enlarged. Average daily quantity of urine for four days 1460 c.c. Urinalysis: Pale urine; specific gravity, 1012; acid; abundant powder-like sediment, contains some shreds, few epithelial and red-blood cells, and a profusion of pus cells. Repeated search for tubercle bacilli negative. Examination with Kelly cystoscope made twice. Bladder normal, except for marked redness and abrasions

about left ureteral orifice. No attempt made to catheterize the ureters.

Diagnosis. Pyonephrosis, probably tubercular. Operation December 15, 1898. Nephrotomy and drainage. Kidney enlarged to twice its size. Three or four ounces of flocculent pus escaped. No stone. Cavity sacculated, with cheesy débris adherent to walls. Patient recovered well from operation, but after three weeks began to fail.

Nephrectomy. January 17, 1897. Operation through line of old wound. Adhesions firm. Pedicle difficult to reach, and therefore clamped with forceps. Wound drained with iodoform gauze. The patient recovered rapidly from the operation, and was discharged from the hospital with fistula February 12th. The fistula has since closed. After the lapse of two years the patient continues in perfect health.

CASE VII. P. R. C., male, aged forty-two years, married. First examination June 12, 1897. Family history negative. No history of gonorrhœa. Eighteen months ago had a severe attack of cystitis, which has continued since in subacute form. During acute stage had some hæmaturia. None since. Still urinates every hour or two. Since beginning of illness urine has been cloudy. Has had temperatures varying from 99° in the morning to 101° in the evening. No rigor. Pain in the back has been quite severe at times, but never very sharp or radiating.

Present State. Man of slight frame, rather emaciated. Slight dulness over right apex. Left kidney quite tender to pressure, and decidedly enlarged. Right kidney not tender nor distinctly palpable. Bimanual examination easily made through relaxed abdomen. Examination for stone negative. Examination with cystoscope shows bladder normal, except for great vascularization of trigonum. No ulceration discernible. Prolonged examination causes such bleeding that the ureteral openings could not be definitely made out. Urinalysis: Acid; very pale; specific gravity, 1014; pus cells in abundance; some red disks in every field. Tubercle bacilli found in considerable numbers in every slide. Patient entered Christ's Hospital June 26. Further examination as to quantity and quality of urine led to the diag-

nosis of primary renal tuberculosis of the left kidney with competence of right gland. Primary nephrectomy by oblique lumbar incision. The kidney when removed was quite twice its normal size. Eight or ten cavities, mostly within the parenchyma, and some of them not communicating with the infundibula, were found.

Subsequent History. The patient recovered from the operation, the quantity of urine passed being eleven, twenty-three and thirty-three ounces respectively. It was nearly clear. On the third day there developed an acute pleuritic effusion, hemorrhagic in character, on the left side. This was aspirated on the second day. The chest refilled rapidly, and death followed on the ninth day after the operation. An autopsy could not be obtained.

Cohnheim, in 1882, first promulgated the view that tuberculosis of the kidney is of hæmatogenous nature; that the kidney is an eliminator for the tubercle bacilli, and that their localization within it is the cause of the disease. Two forms have always been recognized, namely, miliary tuberculosis, which is always bilateral, and only occurs as part of the general tuberculosis. It is not ordinarily recognized during life. The second form is that in which a greater or less number of tubercular nodules is developed within the renal parenchyma, and undergo the necrotic and secondary infectious changes common to tubercles elsewhere. Until Steinthal,[10] in 1885, demonstrated from autopsy records that in one-half of twenty-four cases the process began in the kidney, renal tuberculosis was generally considered as a fatal sequel to disease of the testicle, vas, prostate, or bladder. That it often is simply a factor of uro-genital tuberculosis is shown by the investigations of Heiberg,[11] who found the proportion to be twenty-nine of primary to fifty-five of secondary uro-genital origin. The separation of the genital and urinary tracts eliminates in women the latter form altogether. Yet from a study of the operations of Morris[12] for tuberculosis of the kidney nineteen were in females and only six in males. Of Facklam's[13] table of 103 cases 73 occurred in women. Of

Bangs's[14] table of 133 cases where sex is given, 73, or 55 per cent., occurred in women. Of my own six cases three occurred in women. This is a potent argument in favor of the primary nature of renal tuberculosis, and that in most cases it pursues a descending rather than an ascending course. In this fact alone lies sufficient justification for operative interference in properly selected cases of unilateral disease. The fear of involvement of the other kidney, however well founded, should not defer from operation. Post-mortem investigations anent renal tuberculosis have shown that in 50 per cent. of cases both kidneys are involved. They likewise show that when this is the case one kidney is more diseased than the other, and that when one may show the primary type, the other often presents the ascending form of disease. While it must be conceded that disease in the other kidney is only too often the cause of death after operation, this cause may be averted by earlier and probbably even more so by radical interference.

There is another signal argument in favor of operation. Kidney tuberculosis, like that of other organs, rarely, if ever, remains long unattended by infection with the ordinary pus-formers. That infection, as a rule, occurs early, is manifested by the varied bacteriological aggregation seen in the urine. Indeed, in old-standing cases, a pyonephrosis may altogether mask the true nature of the first pathological condition. The ordinarily chronic course of a localized tuberculosis changes its base, and becomes rapidly fatal from septic absorption. It is for this that interference may become compulsory. If operation is indicated what shall it be, nephrectomy, nephrotomy, or partial incision?

However unsatisfactory statistics may be they must be consulted whenever the individual experience is limited. The first extensive tabulation of operations for renal tuberculosis, after the paper presented to this Association by Gross, in 1885, was that of Facklam. Of twenty nephrotomies, five died from the operation; seven died within three weeks to one year, thus giving a mortality of 60 per cent. The general mortality of nephrectomy is 28 per cent.; of secondary nephrectomies, 37.5 per cent. According to Vigneron,[15] the operative mortality of neph-

rotomy in fifty-four cases is 12 per cent.; the general mortality, 38.18 per cent. Albarran[16] reports on twelve nephrotomies with one immediate death; seven died in from three to seven months; two are living, respectively, four months and ten days after operation, and only one has survived two years. A year ago Bolton Bangs tabulated 135 cases of renal tuberculosis which had been operated upon during the previous ten years. In looking over his cases I find that the nature of the operation is stated in 127. Nephrotomy was performed in thirty-six cases, with five deaths. In twenty-two of the surviving cases secondary nephrectomy resulted with fourteen temporary recoveries and eight deaths; post-operative mortality of secondary nephrectomy, 36.3 per cent. In contrast herewith are the immediate results of primary nephrectomy; ninety-one cases with seventy-one deaths, mortality 78.1 per cent. Albarran reports eight nephrectomies, with seven recoveries, five ranging from one and one-fourth to two and one-half years. In his last report Israel[17] reports a total of twelve nephrectomies, including one partial resection. Eleven were primary; one died after operation. In only one-fourth of the cases did the nephrectomy remove all disease; in the remaining cases bladder, ureter, or opposite kidney was involved. Nevertheless a material improvement resulted. In at least three cases a complete recovery could be recorded. The very limited experience I have had with renal tuberculosis corroborates the teaching of these statistics. Of three nephrotomies two died, and the surviving case has but a short tenure of life. In the nephrectomy that recovered the prognosis is good; more than two years have passed, and she is in excellent health. The partial resection may be likewise considered on the way to a permanent cure.

In renal tuberculosis where operation is indicated the following theses may therefore be promulgated: (1) when the operation reveals a strictly localized lesion a partial excision or curettage should be done; (2) nephrotomy is indicated when uncertainty exists as to the condition of the opposite kidney or for the temporary relief of an acute sepsis, and when the condition of the patient will not permit the major operation. It is

then to be followed as speedily as possible by nephrectomy; (3) unless unusual conditions call for nephrotomy it is not to be advocated for renal tuberculosis. It may even do harm by auto-infection: (4) primary nephrectomy should be considered the normal procedure for renal tuberculosis when an operation is at all indicated.

Here it may be proper to direct attention to the latest triumph of conservatism in renal surgery, namely, the partial excision or resection of the kidney. Based on experimental research and on a few but demonstrative clinical cases, the removal of a portion of the kidney must be advocated under favorable circumstances. First performed by Czerny in 1887, it was through Kümmel[18] that the procedure was made more extensively known by a report of three cases. Cases have since been recorded by Waitz, Bardenheuer, Tuffier, Morris and Nash. In these case-reports a distinction is not made between erasion and resection, for in some of the reports the incision and scraping of a tubercular cavity, as in one of my cases, is considered as a partial nephrectomy. In addition to the eleven cases collected by Bloch,[19] in 1896, I have been enabled to find records of five other cases. All recovered from the operation. So far as primary tuberculosis of the kidney is concerned, it seems certain that when consents for operation can be earlier obtained cases will multiply in which a measure less radical than nephrectomy will be applicable. With few and well localized lesions, erasion or partial excision may avert the need for a nephrectomy.

Nephrolithiasis. Four years ago[20] I published a series of seven cases operated upon for stone in the kidney. Since then I have had two additional operations for stone, and three exploratory incisions, two of which proved negative, and one a local tuberculosis. The success which has followed early operations for kidney stone in the hands of many operators condemns the expectant plan of treatment where the diagnosis is reasonably established until suppurative pyelitis or pyonephrosis compels operation as a life-saving measure. The confidence of the profession at large cannot as yet be said to have been gained for

operation for renal calculus. This is due to the frequency with which operations negative as to the finding of a stone have been made. In the paper above referred to allusion is made to forty-four cases operated with failure to find a stone. Were it in the line of the inquiry—that is the purpose of this paper—the number could doubtless be doubled by including case-reports of the last five years. It is noteworthy that in each of the forty-four cases recovery followed the operation, and in many a permanent cure was effected. The operation, though it may fail to reveal a stone, often leads to the discovery of other pathological conditions which simulate kidney stone and are remediable by operation. It must, I think, be conceded that an absolute diagnosis of stone cannot be made unless by radiography. Whereas in a number of cases the stone has been discovered by oft-repeated exposures, it has failed in many. In a case I recently operated on, two uric-acid stones weighing 89 and 41 grains respectively were not shown in the negative. The increasing frequency with which stones are being located by fluoroscopy makes it probable that in time certainty will be obtainable in the diagnosis of renal calculus. This has not yet been accomplished. We are, therefore, compelled in large measure to rely on the classical clinical phenomena as indications for explorations, although no case ought to be operated on until one or more exposures to the Rœntgen rays have been made. The suggestion of Fenwick[21] to apply fluoroscopy to the exposed kidney will probably long remain little more than a suggestion by reason of technical difficulties.

It is certain that explorations of the kidney are practically devoid of danger. I have made five operations with results negative as to the finding of a stone. In one case I explored the kidney twice. I have personal knowledge of two other cases in the hands of my colleagues. In one of my cases a fistula caused some annoyance for three months. The patient continues well, although the operation was done some six years ago. An exploration with incision is less harmful than the continuance of a stone. Among surgeons, at least, it is fast becoming an axiom that the presence of a renal calculus is an

indication for operation. Although it is usually attended with less suffering than stone in the bladder, it is fraught with greater danger to life. Here the source of destructive changes are already within the kidney, whereas in vesical calculus many years may pass before, by an ascending process, the kidneys are involved.

In the surgical treatment of renal calculus choice must be made between nephrolithotomy, nephrotomy and nephrectomy. Nephrolithotomy should be a routine operation for stone in the kidney. By this procedure the stone is removed through an incision in the substance of pelvis of the kidney, and the wound of the kidney, as well as of the overlying parts, closed by sutures, with primary union in view. Morris[22] has recently presented thirty-three such cases with one death, Tuffier[23] eight cases without a death. Of my own cases but one died as a result of intestinal obstruction, due to pressure paralysis from excessive packing of the wound with gauze. This was the second case of this nature to be recorded. The other occurred in the hands of Israel. The reason for the remarkably low mortality of nephrolithotomy must be sought in the natural tendency of clean kidney wounds to heal by immediate union. Drainage is not desirable. This ideal operation is terminated by closely suturing the wound in the kidney with alternate deep and superficial sutures, traction on which should only be sufficient to keep the edges in apposition. Experimentally and clinically such sutures have been shown to be innocuous, and that the resulting scar tissue involves only the immediate vicinity of the line of incision, provided larger vessels are not included.

How and where shall the kidney be incised in nephrolithotomy? In answering this question two considerations must guide us: hemorrhage and the final result as to a cure without a renal fistula. Hyrtl,[24] as long ago as 1869, demonstrated by corrosive preparations that the kidney is naturally divisible into anterior and posterior segments, the blood-supply of each being independent of that of the other, after the vessels supplying them have been given off from the main trunk of the

renal artery. Along the convexity of the gland, therefore, the longitudinal section made as in an autopsy would be least likely to wound a larger vessel. In twelve operations in which I have resorted to this sectional incision the hemorrhage, while free, was parenchymatous in all. To reduce even this to a minimum the incision should not be made longer than is needful for the introduction of the exploring finger, until the kidney has been brought far enough into the wound to make feasible the compression of its pedicle by padded clamp, or preferably by the fingers of an assistant. This makes the hemorrhage *nil*, while the search for the stone progresses. Such compression has been experimentally maintained for half an hour (Tuffier) in animals without other effect than a transitory albuminuria. In an operation for stone, compression would rarely be needed during more than five minutes. The length of the incision must vary with the difficulties encountered in searching for and removing the stone. With a finger introduced into the kidney through a small incision in the centre of its convexity, or two incisions near the poles, the separate calices can be as methodically explored as are the fingers of a glove. Only after failure of this method to find a stone does the complete division of the kidney from end to end, for ocular inspection, as in a post-mortem examination, seem justifiable. Incisions into the renal pelvis for exploration alone are to be avoided, because of the obviously greater danger of hemorrhage and the dread of lacerating the pelvic wall beyond repair.

Renal fistulæ are seen oftener after incision into the pelvis than after nephrotomy proper, the ratio being as 20 to 3. Therefore, stones found in the pelvis of the kidney should, wherever possible, be removed through an incision in the cortex. In one of my cases a stone was found embedded near the posterior surface. In such a case a radial incision onto the stone, passing between the bloodvessels, is ample for its removal and not attended by severe hemorrhage.

While I believe that not a little importance attaches to the site of the incision in a kidney in every other way sound, Morris, who speaks from an experience of nearly one hundred

operations for stone, considers it quite immaterial whether a calculus be removed through the parenchyma or infundibulum. He writes: "I was formerly of the opinion that there was less chance of urine escaping and quicker healing of the wound when the incision involved the parenchyma only, but since employing sutures I do not find that wounds in the renal pelvis or ureter heal any less rapidly." From a study of the tables of Morris I can come to no conclusion as to the frequency of fistula after his operations.

So long as the kidney containing a stone remains aseptic, nephrolithotomy should be the operation. In not a few cases, however, in which a marked pyelitis is present, suturing of the kidney is justifiable if the ureter is competent to act as a natural drain. When, in consequence of irritation from and secondary infection due to a stone the kidney is enlarged and sacculated, nephrotomy and drainage are the procedures to be adopted. Four years ago I found the mortality of nephrotomy for calculous pyelitis and pyonephrosis to be 21 per cent. Morris out of 43 cases had 10 deaths, a mortality of 23 per cent. In view of the well-known great frequency with which the second kidney is involved in calculous disease (according to Legeu, 38 times in 76 fatal cases), operative interference in pyonephrosis of calculous origin should usually be limited to incision and drainage. Neither the branched form nor the size of the stone should weigh against conservatism. Stones weighing two ounces and more have repeatedly been removed by nephrotomy. Rovsing[25] has recently reported a case in which the kidney was saved after removing a stone weighing 148 grammes. A fistula remained for a short time. It has happened in a few cases that the removal of very large stones was followed by such profuse hemorrhage as to demand nephrectomy, to avert death by loss of blood.

Primary nephrectomy was the routine for suppuration of the kidney from stone until the memorable case of Morris was published in 1881. It is now reserved for the extreme cases of sacculated pyonephrosis, where it is evident that the disorganization of the kidney is such that it cannot be recovered from, and

where there is a minimum of renal parenchyma left. What was observed regarding primary nephrectomy for pyonephrosis finds practical application here. Other things being equal, however, a greater effort at conservatism should be made when the pyonephrosis is of calculous origin. Urinalysis as to the excretion of urea ought certainly to help in determining the functional capacity of the other kidney. The prognosis of nephrectomy for calculous pyonephrosis has hitherto been bad, the statistics of Bardenheuer, Tuffier, and Legeu making it about 40 per cent. Out of 17 cases Morris lost 5; mortality 29 per cent. With a better selection of cases and a greater regard to the condition of the opposite kidney, this mortality will doubtless be reduced.

A further reason for conservatism in the operations for renal calculus lies in the fact that with the removal of the stone the tendency to recurrence in the same or opposite kidney still continues. I need but to refer to the many cases in which both kidneys have been operated on at intervals varying from a few weeks to four or five years.

The Other Kidney. In the foregoing considerations ample allusion has been made to the importance of the other kidney, if, indeed, there are two, before nephrectomy is undertaken. Uræmia in some form or other is the cause of death in almost 50 per cent. of fatal nephrectomies. The statistics of Madelung in this regard I have had an opportunity to verify in the study of statistics and individual case-reports of nephrectomies. The immediate mortality of the operation has been very greatly reduced in the hands of most operators within the past decade, and in part this reduction is ascribable to the greater attention given to the other kidney. Without some definite knowledge as to the functional capacity of the other gland a diseased kidney ought not to be removed. It has been abundantly shown, however, that an absolutely sound remaining kidney is not a *sine qua non* of success in nephrectomy. By timely operation beginning disease in the second gland has been known to be recovered from.

The sources through which knowledge is to be obtained in regard to the remaining kidney are many. To discuss them

individually and at length is beyond the scope of this paper and of my ability, for of some I have had no experience. Within the last decade there have been devised special methods of examinations which tend toward the differentiation of the urines. They have made toward belittling the value of the older clinical methods of careful analysis of symptoms and oft-repeated examination as to quantity and quality of the urine as a whole. I think it right to insist, however, that with patient and careful attention to the history and symptom-complex and diligent study of the urine an approximation as to the functional capacity of the other kidney is possible. With an approach to the normal of the urine in specific gravity, in quantity and percentage of urea, it is reasonably certain that with one kidney badly disorganized the other must be in fair condition. With patience and care in the study of the urine a catastrophe is not likely to follow nephrectomy where there are two kidneys. Palpation is doubtless in this connection a valuable aid to diagnosis. In persons of spare habit or those emaciated by disease, as is often the case in chronic renal suppurations, the kidney can at times be felt by bimanual examination after the method of Israel. In the great majority of cases, however, it leaves the surgeon entirely in the dark.

It is too early yet to conclude anything as to the positive value of radiography, although very much is to be hoped for from it in this field. In repeated exposures of three subjects the kidney left no shadow in the hands of Mr. Taylor, who has done this work for me. With improved methods and greater experience it can be predicted that skiagraphy will be of inestimable value in kidney surgery. Of the special methods of examination cystoscopy either direct or by reflected light should, in my judgment, be first considered, because of the positive knowledge gained by it. Fenwick[26] has recently attempted to show how by its use the mortality of nephrectomy has been directly reduced. From the study of the cases I have reported it will be evident that in a number of them it established the healthy condition of the bladder and the unilateral nature of the disease of the kidney. In a few of my cases it was of no avail.

A few drops of blood in the bladder at times sufficed to obscure the field, which, in my hands, could not be cleared with the irrigating cystoscope. In this regard the examination with the instrument of Kelly is very much more profitable. But under most favorable conditions cystoscopy can only satisfy us of the existence of two ureteral openings, and, therefore, presumably of two kidneys, and that from those issue currents of urine either normal or abnormal. While this is very much, it is not as much as is desirable. For this reason efforts have been made of late to differentiate the urine either by catheterization of the ureters after the methods of Nitze, Casper, Albarran, or Kelly, or by the ingenious segregator of Harris. Of catheterization of the ureters I have had no experience. In the hands of experts, even in women, it is often impossible of accomplishment. Furthermore, it is far from being devoid of danger. According to Hollander,[27] hemorrhage follows it in 50 per cent. of the cases. The danger of infecting a hitherto sound kidney is, consequently, not remote. It is stated that Albarran has catheterized the ureters 700 times, and Casper[28] has a record of nearly as many operations. The latter claims not to have had any infections from the catheter, but Israel demonstrated that in one of his cases a renal neoplasm, removed eleven days after catheterization by Casper himself, showed miliary abscesses the direct result of infection. Furthermore, Casper himself states that ureteral catheterization is contraindicated in renal suppuration attended by fever and in tuberculosis. It does not seem probable, therefore, that ureteral catheterization for diagnostic or therapeutic purposes will long enjoy even a limited field.

More can be hoped for from the segregator of Harris.[29] By means of a double metallic catheter in the bladder and a lever in the rectum or vagina a watershed is formed in the bladder, between the two ureteral orifices, from which the urines of the two kidneys are allowed to flow into separate vials.

My experience with it in two cases has been too limited to warrant an expression of opinion. Harris has used it in over 40 cases, and in a large proportion the demonstration of the functional capacity of the two kidneys was perfect. As the

author himself states, the use of the instrument is limited to permitting a separate analysis of the urines, and that under many conditions, like distortion of the bladder, great hypertrophy of the prostate, of extensive ulceration, the instrument fails of its purpose.

It is not often that with all or most of these methods of examination at our command, doubt will still be entertained as to the condition of the other kidney. Unhappily, in many cases where delay would be fatal, or where from the reduced condition of the patient, repeated cystoscopic examinations possible under anæsthesia would not be practicable, we must take recourse to the last resort for obtaining a knowledge of the functional value of the kidney to remain. This can be obtained by direct ocular and manual examination through an incision. The idea doubtless originated with Knowsley Thornton,[30] who with others claimed as one of the chief advantages of abdominal over lumbar nephrectomy the opportunity it afforded for exploration of both kidneys.

On November 27, 1890, Fenger[31] first made a preliminary lumbar exploration of one kidney before resorting to nephrectomy for malignant disease of the other. In 1898, Edebohls[32] reported three cases in which this practice was followed. He believed this method of exploring the other kidney preliminary to nephrectomy original with himself. It doubtless is; but Fenger has the advantage of priority.

As between transperitoneal and lumbar exploration of the kidney alone, there can be no question as to the advantage of the latter in point of lesser gravity and greater facility of inspection of the kidney. In the Cincinnati Hospital I recently had an excellent demonstration of the ease with which in thin subjects both kidneys and ureters can be palpated by the transperitoneal operation. In fleshy subjects this procedure is of limited value. The signal advantage of this method is the information obtainable about the ureters. When nephrectomy is contemplated, this is, *per se*, of less importance than a full knowledge of the kidney. This can doubtless be better obtained by the lumbar incision. Therefore, for exploratory operations, to determine

the presence and condition of a kidney, the lumbar incision ought to be selected.

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DISCUSSION.

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In discussing this most interesting paper I can only hope to emphasize certain parts and call attention to what seems to me of most practical importance. I have had occasion to make nephrectomy and nephrotomy for all the conditions mentioned—namely, pyonephrosis, tuberculosis, and hydronephrosis. When the pelvis of the kidney becomes dilated with pus and a distinct fluctuating tumor has formed, the operation of nephrotomy—that is, opening the kidney from a lumbar incision—is clearly indicated. The incision is made in exactly the same way as in lumbar nephro-lithotomy, and the abscesses which have formed in the kidney and its pelvis are opened and drained.

Careful search should always be made for renal calculi, since these are the most frequent causes of pyelitis and pyonephrosis.

Frequently the kidney will be almost completely disorganized, and nephrectomy must be resorted to. It is, however, much safer to make a nephrotomy, irrigate and drain the abscess cavity, until the patient has gained strength and recovered from the effects of the suppuration, and then remove the affected organ. In several of my cases I have found that nephrotomy was the only operation necessary; the sinus has healed and the patient has recovered, leaving the kidney to all appearance normal.

Nephrectomy is often necessary also in cases of obstinate fistulæ which persist after nephrotomy, and where the patient is gradually failing under the effects of prolonged suppuration. The acute febrile symptoms and pain of pyonephrosis soon subside after nephrotomy; but before long, unless the suppuration ceases, the patient begins to lose ground, and the only hope of relief lies in extirpation of the kidney.

TUBERCULOSIS. Tuberculosis generally infects the kidneys by ascending from the bladder along the ureter. In some cases it is primary in the kidney, the infection being carried by the blood-vessels. Tuberculosis of the kidney appears under several forms, probably the most common being the miliary, corresponding to the similar condition seen in other organs, and associated with so many lesions elsewhere that it has no practical interest for the surgeon. In

rare cases the changes may remain limited to some part of the kidney, but the disease usually involves the entire organ and spreads to the pelvis, even when it originates in the parenchyma.

A common variety of tuberculosis of the kidney, as I have intimated, is that due to ascending infection from tuberculosis of the bladder. In other cases the gross lesions resemble those of pyonephrosis in general, except that the amount of granulation tissue and cheesy masses make the tumor rather solid than cystic.

It is probable that a large number of cases of supposed ordinary pyonephrosis are really due to tubercular infection, as it is often impossible to demonstrate the tuberculous origin of such advanced lesions.

Symptoms. The symptoms of renal tuberculosis are almost invariably those of bladder disturbance, such as hæmaturia or frequent micturition. It has been said that vesical irritation is the most usual, and often the most pronounced and distressing symptom.

Dickinson asserts that in a case containing pus from the kidneys the absence of bladder symptoms excludes renal tuberculosis. It is more probable, however, that the frequent micturition and vesical tenesmus depend on a beginning tubercular deposit about the lower end of the ureter or in the bladder itself.

The prominence of the vesical symptoms and the coexistence of tubercles elsewhere are most to be depended on for diagnosis. The prognosis is unfavorable.

Treatment. The treatment of renal tuberculosis depends upon the extent of the disease in general. If it is practically limited to one kidney, the lungs or glands being only slightly involved, nephrectomy may result in a radical cure. A slight infection of the bladder or of the prostate does not contraindicate the operation, as it will often improve or disappear afterward. Nephrectomy may be satisfactory even when a well-marked pyonephrosis is present, if the other organs are not seriously affected.

In cases in which there is extensive disease elsewhere, and especially in the other kidney, nephrectomy should not be done, and such cases are best treated on general principles, with due attention to the condition of the bladder.

Nephrotomy results in permanent urinary and tuberculous sinuses, and is apt to hasten a fatal termination; but when the ureters are occluded by any cause, or when the suppuration is so intense as to

threaten septicæmia or pyæmia, the surgeon may be compelled to incise and drain the abscess or the kidney itself.

Hydronephrosis. Hydronephrosis is a condition of overdistention by fluid of the pelvis of the kidney, caused by obstruction of the normal outflow of urine through the ureter or through the urethra.

The symptoms of this condition when it occurs gradually are so little marked as to be unperceived until the tumor reaches a considerable size, for the other kidney gradually hypertrophies and does the work of both. The treatment of hydronephrosis consists of surgical measures only.

The surgical treatment of intermittent hydronephrosis, if it is due to extreme mobility of the kidney, which is usually the case, is fixation of the organ in its proper position, which prevents a return of the obstruction.

In the chronic form the kidney substance may be so altered or destroyed as to be useless, and nephrectomy is the best treatment.

The cyst may be drained either extraperitoneally or through the peritoneal cavity by suture of the sac-wall to the parietal peritoneum, and, as a rule, the drainage will cease spontaneously, owing to the complete destruction of the kidney tissue. If discharge of the urine through the fistula should persist, nephrectomy may be performed by cutting down on the remains of the kidney and the cyst and removing the entire mass.

A question of much practical importance is the comparative value of lumbar and abdominal nephrectomy.

In cases of pyonephrosis it is necessary to operate extraperitoneally, on account of the danger of infecting the peritoneal cavity. Even in cases of solid tumors without infection it is well to employ this operation, because the ureter must be left in the pedicle and is a frequent source of infection.

For a tumor of very large size, however, the transperitoneal method has frequently been used with success, the mortality being but little higher than that of the extraperitoneal operation. In the transperitoneal operation the incision may be made in the middle line or at the external border of the rectus, opening the peritoneal cavity directly. The intestines are pressed over to the opposite side of the abdominal cavity and thoroughly protected by sterilized gauze.

The peritoneal covering of the kidney is then opened on the outer side of the colon and the latter displaced inward, when the kidney

can be dissected from its bed and lifted into the wound. The ureter and vessels are separated and tied with separate catgut ligatures.

If the ureter is full of infectious material it should be secured in the anterior abdominal wound, or, better still, a counter-opening may be made in the lumbar region and the ureter stitched to the margin of the incision. If the ureter is not infected it may be dropped back with the rest of the pedicle and the posterior layer of the peritoneum united over it.

Lumbar Nephrectomy. *Advantages.* The peritoneum is not opened. Excellent drainage can be secured. If putrid pus escapes the area of infection is small. If nephrectomy be abandoned the possibly-diseased organ is left in a convenient position. The operation is of special service when dense posterior adhesions exist.

The wound is large enough for all ordinary purposes.

Disadvantages. The operation is difficult in the corpulent. There is some danger of wounding the pleura. The kidney is not always very easily found. The peritoneum and the colon are in danger when extensive anterior adhesions exist. The pedicle is not so easily reached and secured. The kidney is more likely to be torn in removal. The operation is not adapted for large tumors. The opposite kidney cannot be examined.

Abdominal Nephrectomy. *Advantages.* Ample room is provided and the kidney is readily found. The pedicle is easily reached and secured. If the incision is in a semilunar line a series of muscles are not divided. The opposite kidney can be examined. Tumors of any size can be removed.

Disadvantages. The peritoneum is opened and may be infected should pus escape during the operation. Unless a second incision is made in the loin efficient drainage is not provided.

When dense posterior adhesions exist the operation may be very difficult. The tendency to a ventral hernia is greater than is the case in lumbar nephrectomy.

In general terms, the mortality attending the operation of nephrectomy may be placed at about 40 per cent.

Dr. Newman gives the mortality after lumbar nephrectomy as 30.5 per cent., and after the abdominal method as 47.1 per cent.

Death has been due to shock, to hemorrhage, to uræmia and anuria, to peritonitis and septic infection. In the case of movable kidney alone, Newman in a series of thirty cases gave fifteen recoveries and nine deaths

in abdominal nephrectomy; the lumbar operation was performed six times without a death. In a series of forty-six cases of nephrectomy performed for hydronephrosis and cystic disease, collected by Newman, there were nineteen deaths—a mortality of 41.3 per cent. Sixteen of these fatal results occurred in the thirty-two cases where the abdominal method had been practised; hence the transperitoneal method showed a mortality of 50 per cent., while the lumbar method showed a mortality of 21.2 per cent.

HERNIA FOLLOWING OPERATIONS FOR APPENDICITIS.

BY FRANCIS B. HARRINGTON, M.D.,
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AT the Massachusetts General Hospital, from January, 1888, to August, 1897, 503 cases of appendicitis of all varieties recovered after operation by the various surgeons. The figures here presented are from a personal examination of 236 of these cases. The examinations were made with the special purpose of observing the condition of the abdominal wall following this operation.

The time which had elapsed since operation varied from nine months to nine years. With the consent of the visiting surgeons of the hospital, and with the assistance of Dr. E. A. Codman, an interrogatory letter was sent each one of the 503 patients who recovered. Replies were received from 375.

Of this number 236 came to the hospital for examination. These cases date from the earliest period of operative interference in appendicitis. The method of operation varied from time to time, and with the different surgeons. No attempt has been made to compare the results of the various operators, as the method of treating the abdominal walls did not vary radically.

Many of these, who reported themselves as perfectly well, had marked general bulging of the abdominal wall on the side operated upon. Some had protrusions in the wound, and some had hernias of which they were not aware, as they caused no trouble. The scars resulting from the operation varied greatly in character, as all scars do. In length they varied from one and one-half to seven inches. In width they varied from the linear to the very broad, in some instances being four inches

wide, showing the result of stretching. Occasionally a scar showed a keloid condition.

The scars varied in color, being pale, white, brown, red, and purple. The wearing of a belt seemed to make little difference in the condition of the abdominal wall, nor do I believe that belts are of much value, except for a short time after operation. The scar and the abdominal wall showed the best condition in those wounds which were tightly closed. Those wounds which were partly closed showed better results than those which were left open.

All of the wounds which were not tightly closed were drained usually by wicks of gauze or by tubular drainage, the amount of drainage material varying with different cases. The incisions in the unclosed wounds varied, but for the greater part were oblique either in the linea semilunaris or outside of it. In the unclosed wounds during the period mentioned, from 1888 to 1897, some of the muscular or tendinous tissues were usually transversely cut. This cutting directly across muscular fibres frequently occurred in the cases which were closed at the time of operation. Of the 236 cases examined 85 were tightly closed at time of operation; 88 were partly closed at time of operation; 63 were open wounds, no sutures being used.

Intermuscular Spaces. The examination of the tissues under the scar showed in many of the cases that the edges of the incised external rectus muscle, or its tendon, could be felt, and the fingers inserted between these edges. Sometimes the edges of the internal oblique and rectus muscles could be felt. Examined with reference to the intermuscular or intertendinous spaces which could be detected, it was found that 26 per cent. of the tightly closed wounds showed such spaces; 83 per cent. of those partly closed showed such spaces; 87 per cent. of those left open showed such spaces.

These intermuscular spaces result from cutting or separation of the muscles which are not brought into apposition by sutures. If they are kept apart during the healing process by gauze or other drainage, the amount of separation becomes greater and more a source of danger. These conditions are increased if the

muscles are transversely cut. The degree of intermuscular separation has been indicated in the following table by the terms slight, medium, and large, these terms referring both to the length and to the width of the spaces:

INTERMUSCULAR SPACES.

		Slight.	Medium.	Large.	Total.
Closed incisions . .	85	17	2	3	22 = 26 per cent.
Partly closed incisions.	88	28	20	25	73 = 83 per cent.
Open incisions . .	63	14	17	24	55 = 87 per cent.
Total cases examined .	236				

It is interesting to note that there were twenty-three cases, in which the wound was left wholly or partly open, where a solid wall resulted. These cases were mostly in young muscular subjects.

General Abdominal Bulge. When we inspect the general appearance of the abdomen we often find that the wall on the side operated upon, if compared with the opposite side, protrudes upon standing or straining.

The protrusion may occupy, in a general way, the whole of the right side, or of a considerable area in the region of the scar. This protrusion I have called "general abdominal bulge."

It has been claimed that this bulging is the result of paralysis of the muscles from sections of the nerves. It has seemed to me more probable that it resulted from the cutting of the muscles and tendons, and the separation and stretching of these parts. In dissecting a scar in such an abdomen I have found the fibres of the external oblique and the internal oblique and transversalis muscles lacking in juxtaposition by a space of from one-half to two inches.

It can be readily seen that this separation would increase the area of the abdominal wall upon the right side. When these muscles are reunited, layer by layer, as they originally existed, this general bulging disappears to a large extent.

"GENERAL ABDOMINAL BULGE."

Closed incisions	85	6 cases = 7 per cent.
Partly closed incisions	88	40 cases = 45 per cent.
Open incisions	65	29 cases = 46 per cent.

HERNIA. We now come to the consideration of hernia existing in the cases examined.

Punctiform Hernia. In some of these cases little openings in the scar tissue existed, usually not larger than the point of a pencil, through which could be felt the impulse of a small portion of the abdominal contents. These have been designated "punctiform hernias."

There were ten of these, all occurring in the cases which were left partly or entirely open. It did not seem probable that these cases would develop into true hernias. None of them caused pain, and the patients were for the most part unaware of their existence.

These openings might all be closed without difficulty, and should be closed if they showed a tendency to enlarge. It is probable that some of these would close in time by the proper development of the abdominal wall, as small hernias often do in infants.

Bulging in the Scar. Among the 236 patients examined were some cases of protrusion into the scar which might develop into true hernias, but which could not be properly classed as hernias. No constriction existed, and the bulging only appeared on straining. The condition indicated a general weakness in the abdominal wall at the region of the scar.

These cases were almost always accompanied by general abdominal bulging. There were 52 cases of this "bulging in the wound." In 27 cases the bulging in the wound was very slight. Two of these slight bulgings occurred in the tightly closed wound, and were the only examples of "bulging in the scar" in this class of cases.

The other 25 cases of bulging were of considerable size, varying in length and in width from one inch to four inches. In all of these latter cases I think the wound should be reopened and tightly closed. For the most part they gave the patient no trouble, and apparently were not increasing in area.

There were 27 cases of true hernia in the 236 patients examined.

Total number examined			236
Number of males			190
Number of females			46
True hernias in all			27 = 11½ per cent.
In males			21 = 11 per cent.
In females			6 = 13⅓ per cent.
Wounds closed at time of operation,	85	with 3 hernias	= 3½ per cent.
Wounds partly closed at time of operation	88	with 11 hernias	= 12½ per cent.
Wounds left open at time of operation	63	with 13 hernias	= 20 per cent.

	Incisions.	Punctiform hernia.	Bulging in wound.	True hernia.	
Closed	85	0	2	3 = 6	per cent.
Partly Closed	88	5	29	11 = 51	per cent.
Open	63	5	21	13 = 62	per cent.

It is to be remembered that in the closed wounds the muscles and the fascia were frequently transversely cut, and the wound closed only by a single layer of stitches, which would not insure accurate approximation of the cut muscles. The scars in the cases of hernia averaged four inches in length. In these cases hernia occurred somewhat more frequently in women than in men. This, I think, will be found to be a general fact, due, probably, to inferior muscular development in women. In all the cases of hernia, except two, the patients had worn supporters.

Wounds partly closed were followed by fewer hernias than open wounds. Weakening of the abdominal wall existed in a large percentage of the cases which were drained. This enumeration indicates that all cases should be kept under observation. It indicates that drainage should be reduced to as small an amount as is consistent with safety, and dispensed with if possible.

A large proportion of these cases of weakened abdominal wall can be cured or improved by operation. I have operated upon four cases of hernia with excellent results. The operation should consist in a removal of the scar tissue. Adhesions of the abdominal contents to the scar should be separated. The wound should be large enough to allow a thorough identification of the various layers of the muscles, tendons, and fascia.

The peritoneum with the tranversalis fascia should first be closed; then the internal oblique and transversalis. If these muscles have been cut across they should be reunited, so as to restore the original condition as nearly as possible. The external oblique should then be restored and the wound closed.

The after-treatment of a hernia operation should be similar to that employed in any closed appendix operation.

For the "interval operation," it is universally admitted that the muscular tissues should not be cut across the fibres. The McBurney incision has been very generally employed for this purpose. Since November, 1896, Dr. C. B. Porter has made a longitudinal incision through the outer border of the rectus in the "interval operation," with excellent results. This incision is now employed by a number of surgeons.

In the acute cases McBurney recommends the cutting of the internal oblique and transversalis muscles across the fibres. This is the method usually adopted. I have found it possible by enlarging the McBurney incision for "interval" cases to obtain sufficient opening to treat a large proportion of the acute inflammatory cases. The operation is as follows:

Make an incision in the skin four to five inches long in a line with the fibres of the external oblique muscle, at such a distance from the anterior superior spine of the ilium as is desirable. Separate the muscle and its tendon, without cutting, for a like distance; then insert retractors one and one-half inches broad at either end. The middle of the incision should correspond to the usual position of the base of the appendix. At this point the internal oblique and the transversalis muscles run nearly parallel and horizontal. These should be separated, without cutting, down to the transversalis fascia, and from the ilium to the linea semilunaris. If this does not give sufficient room, the sheath of the rectus may be separated in front and behind the muscle in a line continuous with the separation of the internal oblique and transversalis muscles.

The sheath of the rectus muscles is formed by the aponeuroses of the oblique and transversalis muscles. The direction of the fibres of the sheath is horizontal, being at right angles to

the line of the muscular fibres of the rectus. At the semilunar line it will be necessary to use the knife or scissors, since at this point the union of the various aponeuroses is very compact. The rectus muscle can then be drawn toward the linea alba and considerable room obtained.

Care should be taken not to cut the deep epigastric artery, which at this point lies inside the rectal sheath in the posterior part of the muscle. If necessary it may be tied. Two retractors, each about two inches broad, should be inserted, one at either end of the deep incision. The retractors which have been used for the external oblique can now be dispensed with.

To approach the appendix in cases of acute inflammation, with or without suppuration, I have made it a point for a number of years to enter the general abdominal cavity beyond the region of the appendicular mass. The inflammatory mass is not attacked until its extent and outline have been determined and it has been isolated by a wall of gauze. This method gives good results.

Having cut through the transversalis fascia and the peritoneum in a line with the deep incision, we have an opening into the abdominal cavity two inches wide and from two to four or more inches long. This is sufficient for nearly all operations upon the appendix.

No portion of the tissues essential to the integrity of the abdominal wall has been cut through, except for a slight incision at the semilunar line. The opening of the rectal sheath is frequently found to be unnecessary. When the retractors are removed the muscular layers come together, and even without sutures present a firm obstruction to the protrusion of the abdominal contents. If the rectal sheath has been opened it should be closed with sutures. A suture should be used to unite the cut edges of the linea semilunaris. Other sutures should be used as far as drainage will permit. If drainage can be avoided, then the separate layers of muscle should be closed carefully. All drainage should be removed as soon as safety will permit.

When the wound has healed and the stitches have been re-

moved the patient should be taught to make gradual and careful use of the abdominal muscles, in order to restore them to their normal tone. For a month after healing a simple supporting swathe may be used, but the prolonged use of abdominal belts or trusses seems to me undesirable. If a patient wears a firm abdominal belt, and is advised to make little use of the abdominal muscles, there is danger that the muscles may become atrophied and atonic from non-use, as the muscles of the arm or leg do when in splints.

Gymnastic exercises for the development of the abdominal muscles should be carefully and persistently followed out. These exercises seem to me of great importance. Some of the best results in cases which were drained occurred in men who were obliged to resume laborious work soon after leaving the hospital.

Having practised for two or three months at home those exercises which tend to develop the abdominal muscles, the patient may, with safety, begin the more active out-door exercises, such as bicycling, rowing, canoeing, and golfing, or if his work is laborious he may resume it.

The following exercises are suggested for home use, the amount of effort being gradually increased :

1. Bend the trunk forward, backward, laterally, and, lastly, circularly. At first, hands on the hips; to increase work, hands at neck.

2. Lying on back, hands at neck; lift the legs stretched (very slowly) as far as the vertical; lower them slowly.

3. Sit on bench about one foot high, feet supported under bed or bureau; bend trunk backward 45°; hands at hips.

The exercises are desirable, even in cases in which some portion of the abdominal muscles or tendons have been cut transversely. If a tendency to protrusion appears, an operation to reunite the severed tissues will be desirable.

For the past sixteen months I have followed this method of operation and of after-treatment in acute cases. It rarely has been necessary to cut muscular or tendinous fibres. Immediately after the wound has healed, gradual use of the abdominal

muscles has been encouraged. Abdominal belts have not been used. The results thus far have been very satisfactory, even in those cases in which the wounds have been left open for drainage.

The "enlarged McBurney incision" does not interfere with drainage. After drainage has been removed and the wound has healed, if the uncut muscles are exercised while the granulation tissue is soft and pliable, they tend to resume their original position and strength. Thus the space made by the drainage is closed, and the separated muscles come into apposition. A patient of this class was allowed, eight months after operation, to train and enter a boat-race, with the best results.

RÉSUMÉ. Hernia and bulging occur frequently after operation for appendicitis, and result from the separation of muscles and other tissues in the scar. They are very common when drainage has been used.

The muscular and tendinous fibres should not be transversely cut in any appendix operation unless it is unavoidable.

As little drainage material as safety will permit should be used.

When drainage is necessary the wound should be closed, as far as possible, with sutures, and the drainage removed early.

If the wound can be closed immediately, the tissues should be restored to their normal position by suturing each layer.

Stout belts and trusses are of little value in preventing hernia, and may even do harm.

The abdominal muscles, from the earliest period possible after operation, should be developed by appropriate exercises.

If hernia or marked bulging appears operation for cure is safe and satisfactory.

SOME UNUSUAL CASES OF APPENDICITIS, WITH COMPLICATIONS.

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IT is probable that the field of operative surgery in its relation to the appendix will ever present rare and unusual cases. This was illustrated at our last annual meeting, when the President and others gave us the histories of some very unusual lesions in this part of the abdomen. The very fact that our programme has, at this meeting, given so much attention to the subject, in the way of valuable papers and impressive discussions, is confirmatory of the continued watchfulness maintained by the operating surgeon in this sphere of work.

We may examine our cases with ever so much care—with ever so much intelligence; we may employ our diagnostic skill to the best advantage; we may acquit ourselves in ever so creditable a manner, but when once we enter the peritoneal cavity we must, as abdominal surgeons, be prepared for surprises.

From the knowledge acquired in the finding of these isolated and rather rare cases we are better able to turn to the new cases which present—and which do present—an unmistakable argument for operative intervention; presenting a line of argument to those who are interested that will be more impressive, and in that way making it more possible for us to increase the percentage of recoveries when once this condition becomes surgical, requiring the skill of the surgeon to bring the patient through successfully.

Our medical journals in the past and our special works upon abdominal surgery and text-books give us the histories of cases

which are of great value, but even yet we come to conditions that present complications rare and unusual.

No longer is the hernial sac, with the appendix found therein, particularly rare, but to find it with a foreign substance like a pin immediately in the appendix, as my associate, Dr. MacDonald has, and not having caused any trouble, is somewhat unusual.

To operate for relief of femoral hernia in the female, and find not only the appendix but a prolapsed bladder, is certainly decidedly rare, and yet a condition one would like to be acquainted with if coming upon a similar case. Cases of appendectomy in which we find the right ovary implicated, and where we are obliged to remove the latter, are not so very rare, and yet at one time did present a degree of rarity to many operating surgeons.

The position of the appendix, form, shape, stenosis, distention, dropsy, all of these conditions are quite familiar to us. I have believed it might be of interest to present the following cases and place them on record, as the complications are somewhat unusual.

CASE I.—June, 1895, Mrs. G., aged fifty years, presented with the history of a fistula in the right inguinal region, following the spontaneous opening of an abscess, after weeks of suffering, and I was consulted for relief of the annoyance of the fecal discharge. I stated to her family physician, herself, and family, that I believed she had had an attack of appendicitis with abscess, and that an operation should be done, to ascertain what was left of the appendix and to close the fecal fistula. The very decided reluctance that had prevented her from having the abscess opened still continued, and she declined to have anything of the sort carried out. Her physician consulted me again at the end of six weeks, giving the usual history in these cases—*i. e.*, that whenever she ate of blackberries, or anything containing seeds, that many of them would pass out through the fistulous tract. I simply emphasized that I could do little aside from the directions that had already been given as regards cleanliness, care of the bowels, etc. Six months afterward the doctor, in consulting me regarding a similar case, informed me Mrs. G. had entirely recovered; that a month

after his second consultation with me she passed what was originally a black pin, two and one-half inches in length, very much corroded, and covered with hard phosphatic deposits, and that very soon after this the fistulous tract closed, remaining healed since. Evidently nature did much for this patient.

CASE II.—Mrs. S., aged twenty-six years, married, no children, suffered very much during her menstrual periods in the right side of the pelvis. Patient consulted me in June, 1897, for a hard mass that could be felt in the right inguinal region, and for a chronic cystitis, with much pus in the urine, and some blood at times. She gave a history of having had a serious attack of "inflammation of the bowels," as diagnosed by her elderly family physician six months previously. There was great distention at the time; she was seriously ill, and it was thought she could not recover. I said to her present physician, a younger man, and who had looked after her case with much care, that I agreed with him that she undoubtedly had had appendicitis, and that there was now a relation between the appendix, the abscess cavity, and the discharge from the bladder—the abscess cavity opening into the bladder beyond a doubt. He stated to me it was believed by another surgeon who had seen her that the case was one of ovarian abscess, and that the pus entered the bladder from this source. She came to see me two weeks later, and brought with her several foreign substances, such as blackberry seeds, leaves of lettuce, and other vegetables she had passed from the bladder. This seemed quite confirmatory of the possibility of the appendix being the source of the trouble. I advised an immediate operation, but she procrastinated at the time, and in a letter received from Dr. Stafford, May 26, 1899, regarding Mrs. S.'s case, he states she is better, but still in the same condition, some days feeling pretty well, others not. Just at present she is in very fair health, not troubled with the former burning sensation so much, and does not desire an operation unless she grows very much worse.

CASE III.—Mrs. C. B., aged thirty-nine years, married, menstruated at sixteen, regular, but always suffered more or less pain until after her marriage at twenty-one and birth of first child. Has had six children, the last twins, born four years ago. Has had three miscarriages, the last in August, 1896. February 22, 1897, believing herself to be pregnant, she noticed some discharge, and soon after passed a fœtus of about three months, nothing more than that being recognized. Three days later she passed what was believed to be the remains of

the conception, and now gave a history of several weeks of pain and suffering, sometimes in the left ovary, but more particularly in the right. When I was called to see her, April 7, 1897, she presented the physical signs of abscess of the right inguinal region, extending back behind the caecum. Patient suffered a great deal of nausea, vomiting more or less a yellowish, green-looking fluid, severe exacerbation of fever, followed with profuse sweats, pain more pronounced at times, had lost much in flesh, right leg drawn up, unable to extend it, and her general condition presented all the emphasis possible for surgical intervention. She was brought to the Albany Hospital, and, on examination of her urine, there was found at least 20 per cent. of albumin present, with granular and hyaline casts. The lower bowel was thoroughly emptied out by means of stimulating injections, and on careful examination of the pelvis bimanually the uterus was movable, left broad ligament and ovary easily defined, but at the outer portion of the broad ligament on the right side there was a boundary line of abscess wall, evidently, and the ovary could not be located. Giving her chloroform I made a quick and thorough dissection, believing I had a case of abscess in connection with the appendix, and which I reached after some deep dissecting, evacuating a large quantity of pus, and passed a long drainage tube out through the lumbar region. The character of the pus, etc., indicated a connection with the bowel, and in the detritus I was quite sure I discovered gangrenous portions of the appendix. The pus cavity was thoroughly washed out, irrigation continued, and while the patient continued to have a large amount of albumin in her urine, also a great number of granular and hyaline casts, yet she ultimately made a perfect recovery, and has remained well for the past year, without any trace of kidney trouble or of irritation of the old abscess cavity or wound. Menstruation is normal, and her general condition of health excellent.

Was there a relation between this septic state and her albuminuria or Bright's?

I have a record of a number of cases of tuberculosis of the appendix which have seemed to me to be largely the nature of metastasis, and upon which I hope some day in the near future to present a paper.

CASE IV.—This is a very sad case in its presentation of a record of persistent suffering quite unusual for the patient to stand up against.

Miss D. J. A., aged fifty-one years, with a history as follows: Father never strong, and died in his fortieth year, after an operation for abscess in the groin. Inasmuch as this operation was done many years ago it is possible the trouble was tubercular, from some disease of the spine or elsewhere, as his family history presented a number of cases of phthisis. Mother of patient living and in good health. Miss A. was never strong. Had all the diseases of childhood before the age of ten. At the age of twenty-two had an attack of pleurisy, followed by phlebitis in the left leg, and was ill for a long time, but ultimately recovered. Not long after had an attack of typhoid fever; confined to the bed for six weeks, convalesced rapidly and enjoyed good health for quite a period, then suffered from scanty menstruation accompanied with much pain, and was treated for two years by her family physician without any beneficial results. She was then operated upon by a specialist—simple dilatation of the cervix—was relieved, and remained in good health for more than two years. Then after exposure, as she believed, had a sudden and severe attack of peritonitis, pain commencing in the upper portion of abdomen, as she stated. Patient confined to her bed for several weeks. In the spring of 1887 she had another similar attack, but the pain was located more particularly in the right inguinal region, and from which she was some time in recovering.

She now remained very well until 1894, when she had another attack, not so severe, and for which I attended her, believing the case to be one of ovarian trouble, possibly complicated with appendicitis. Following this she had much pain in the rectum, which proved to be caused by a fissure, and was relieved by over-distention. Soon after this she suffered from a severe attack of biliary colic, becoming very much jaundiced, and at one time I thought it would be necessary to do a cholecystotomy, but suddenly the case yielded to treatment and she made a good recovery. In January, 1896, she noticed a bunch in her left breast, which developed rapidly, and for which I did a thorough operation, March 7, 1896, the tumor proving to be a cystic sarcoma. She made a most remarkable recovery from this operation, gaining in flesh and strength rapidly.

In May, 1897, she complained of a good deal of pain in the right side, in the region of the appendix, this whole portion being exceedingly sensitive to the touch. Ice was applied for about ten days, with considerable relief, then hot applications, and the bowels kept moving

by means of enemas. A distinct tumor could be made out. I was strongly of the impression that we had a growth here somewhat similar to that removed with the left mammary gland, and was quite reluctant to do an operation. However, on the 10th of July, 1897, it became apparent we could no longer delay if surgical intervention was to be carried out. I made a thorough exploration, found the head of the cæcum and the parts so matted together by a large mass, that seemed to be the nature of sarcoma, and the adhesions so great that I could not isolate the head of the cæcum and appendix to do a resection. I simply placed drainage in the wound and watched for results. After a few days the wound discharged somewhat freely, irrigation was kept up, the wound carefully drained, and the patient made a good recovery. The wound ultimately closed, and the phlegmon, sarcoma, mass, or whatever it may have been, entirely disappeared, her bowels moving regularly. On January 8, 1899, she was taken with severe pain in the region of the appendix, and it was very apparent there was serious trouble there. We had great trouble in getting the bowels to move by means of rectal enemas, high or otherwise, and it became absolutely necessary, on January 14th, to make a free incision, opening up the old scar, and seeing as to the condition. I found a great number of adhesions implicating the head of the cæcum and the ileo-cæcal region, a stenosis of the ileum at the ileo-cæcal valve, the intestinal tissue very friable, and in attempting to loosen up the adhesions to make a resection, I opened into the cæcum as well as the ileum. The patient's strength began to fail so rapidly I could only fasten the ileum and the lower end of the cæcum into the incision and close as expeditiously as possible. The patient became more and more comatose, and died within eighteen hours after the operation. The portion of the mass I removed afterward proved, on examination, to be sarcoma.

What was the relation between the cystic sarcoma of the breast and the sarcoma of the appendix?

We have at times a serious complication presented to us, when being called to a distant part of the country we find a case with a pulse of 120 and great embarrassment of the heart, due to serious distention of the intestines pushing up against the diaphragm. Uncertain as to the point of possible obstruction, and yet very positive that it is due to appendicitis from the

history of the case, patient not in condition to bear a severe exploration, and when on opening the peritoneal cavity we do not find any evidence of septic peritonitis, patient now unable to stand a long search for point of obstruction, I feel justified and believe that doing a simple colostomy, letting the intestines drain, then doing an operation later on, saves more lives than the attempt to do the operation at the time, as illustrated by the following cases:

CASE V.—Mr. L. P. S., aged twenty-nine years, family history good. I first saw him February 26, 1898, when he had an attack of severe pain in the right inguinal region, extending throughout the abdomen, with great distention, which had lasted for three days. Various unsuccessful efforts had been made to move his bowels; his physician, Dr. Still, and a trained nurse having accomplished all that was possible. He gave a history of having had three similar attacks within the past two years. His pulse ranged from 110 to 128. No rise in temperature, but an occasional attempt at vomiting. I realized that his case was undoubtedly one of appendicitis with obstruction, and that his condition was such he could not tolerate any extensive examination of the intestinal tract. I opened the abdominal cavity, with the understanding that if I did not by quick examination find the point of obstruction I would then form an artificial anus and watch for developments. I made a median incision quite high up, but was distressed to find that I had opened into an elongated, permeable urachus which connected with the bladder; however, this was quickly closed, and then upon entering the peritoneal cavity the coils of intestines rolled up into the wound with considerable energy. Passing my finger to the right I was unable to locate the obstruction as I wished, so simply made an opening into a coil of small intestine, and established an artificial anus. A very free discharge followed from the bowels during the next thirty-six hours; patient was comfortable at once, and went on to marked improvement, the only unpleasant complication being a fistulous opening which formed on the tenth day after the operation, in connection with the bladder, discharging urine for some time, but finally closed.

On March 16, 1898, he entered the Albany Hospital for closure of the fecal fistula. A median incision was made, the opening in the bowel loosened up and ligatured so as to prevent the escape of feces

into the peritoneal cavity; but notwithstanding my greatest care in loosening up a coil of intestine about six inches from the fecal fistula, I found it connected with the posterior fundus of the bladder, and perforated both intestine and bladder. A resection of the small intestine of more than six inches was made, the Murphy button inserted, and the intestine dropped back into the peritoneal cavity. The opening into the bladder was closed with silk sutures, after having removed the elongated urachus, and fastened it into the lower portion of the wound, very low down. Now, upon examining the contents of the abdomen very carefully for the constriction that had caused the obstruction, I found an elongated appendix, bound around a coil of the ileum and containing two fecal concretions yet within the appendix, which had not ulcerated through. The appendix was loosened up from its adhesions and removed. Patient passed Murphy button on seventeenth day, and on the following day, and for a few days afterward, had some urine escape from the lower portion of the wound, presumably where I had attached the remains of the urachus. This closed, however, without any trouble, giving the patient a good, solid scar. Mr. S. made a good recovery.

In August, 1898, he noticed some irritation in passing urine, in September passing two of the silk sutures out through the bladder. The irritation continued, however, and February 16, 1899, he again entered the hospital. On examination I found he had a vesical calculus. Under cocaine this was crushed, and the patient made a rapid recovery. It was very gratifying to see the improvement in his urine within seventy-two hours after the operation. On washing out the bladder the urine became absolutely normal, and has remained so since, the patient calling on me only a few days since in perfect health.

I am sure that had I gone on and made a thorough exploration in this case the night I saw the patient he would scarcely have recovered.

Case VI.—Master L. W., aged twelve years, in the practice of Dr. Griswold, gave a history of two previous attacks of appendicitis, and with the urgent advice on the part of the doctor to have an immediate operation, but this his people declined to do. In his third attack I saw him with the doctor, after several days of illness, when the patient was vomiting considerably, his abdomen very greatly distended, pulse ranging from 100 to 120 and 140, and all attempts in getting a movement of the bowels had failed. He was brought to the Albany Hospital, October 25, 1898. Upon opening the peritoneal cavity, in the

absence of any septic peritonitis being present, I opened a loop of the intestine and gave him a fecal fistula. He was very ill for three weeks afterward, the fistulous opening discharging very freely. At the end of the second week he had some liquid movements from the rectum, and finally left the hospital November 28th, taking his nourishment well, and having gained somewhat in strength. He returned to the hospital, May 20, 1899, for closure of the fistula. I opened up the peritoneal cavity very much in the same manner as the previous case, but found such a mass of adhesions as I have seldom come in contact with. In loosening up the adhesions of the intestine I found perforation of the bowel in three distinct places, which, together with the fistula, I closed with Lembert's sutures. I was unable to find any portion of the appendix, but found an elongated portion of the omentum, cord-like, that held a loop of intestines down in the pelvis, in connection with the rectum, on the left side. In loosening this up I perforated a portion of the rectum, and found it impossible to close in any manner I could make use of; but having loosened all the coils of intestines elsewhere, his strength failing very rapidly, I finally found it necessary to bring that portion of the rectum up to the under surface of the abdomen. I then introduced two pledgets of iodoform gauze, and trusted to getting a fecal fistula as the only possible way of preventing immediate death. This patient has done remarkably well. The intestinal tract was thoroughly restored above, the wound has gone on healing well, yet from the lower portion there is some escape of feces, although he has had good fecal discharges from the rectum in a normal manner.

A complication that is somewhat unusual, and yet of very great interest to the surgeon at the time, is the opening into the intestine when loosening up a mass of adhesions, in cases of appendicitis where the attacks have been so evident, so positive and pronounced, that you wonder at the procrastination of patients, friends, and physicians, as illustrated by the following cases:

Case VII.—Mr. H. S., aged twenty-five years, single, farmer by occupation. Patient gave history of at least three attacks of appendicitis. When I saw him, in October, 1897, he was suffering from indigestion, intestinal distention, marked constipation at times, and in more or less

pain. I indorsed the opinion of his family physician, Dr. Sherman, that an operation ought to be done, and on October 19, 1897, at my private hospital, I opened down upon the appendix, and found centring upon it, and attached to one another and the appendix itself, three coils of small intestines; adhesions firm, and the gurgling of gas from one fold of intestine to another most perfect in every respect. With great care I thoroughly loosened up the adhesions, but found I had three perforations to deal with—one nearly the size of the end of my little finger, two smaller, and separated from each other by at least two feet. By careful manipulation I was able to close with Lembert's sutures. This patient made a good recovery.

CASE VIII.—On the next day, October 20, 1897, private hospital, I operated upon Miss S. G. L., aged twenty-one years, who presented almost the same history as the previous patient, although she had been confined to her bed for the past four months, with much suffering in the right inguinal region. On reaching the appendix I found the adhesions of the small intestines almost precisely similar to previous case, with two openings in the intestines, which were closed in like manner; then was obliged to remove the right ovary and tube, as they were implicated in the mass of adhesions. The operation was long and tedious, and the ovary presented a small abscess. Drainage was necessary, and the patient made a good recovery, although far more tedious than that of Mr. S.

These last two cases are but types of such complications as present in delayed operations.

DISCUSSION.

DR. MAURICE H. RICHARDSON, of Boston.

The peculiar cases reported by Dr. Vander Veer interested me very much, because we can never tell when we open the abdomen for appendicitis what we are going to find. In one case we may find tuberculosis when we expect appendicitis. In another case we may operate for appendicitis, remove the appendix, and in a short time cancer results.

DR. JOHN E. OWENS, of Chicago.

Just a word or two, Mr. President, in regard to these cases of appendicitis or perityphlitis, if you will pardon the use of a term which was used some thirty years ago for this condition. As long ago as that I saw my first case.

A young man had been eating chestnuts, and, after wrestling with a companion, he developed what was then called perityphlitis (appendicitis). The case terminated fatally. At the post-mortem we found perforation, with pieces of chestnut in the appendix, and also in the abdominal cavity.

Within the past ten days or two weeks a member of my own family had a severe attack of appendicitis with perforation. A fecal concretion was found in the appendix, and, in the midst of this, a No. 8 bird shot and a flake of oyster shell, a corner of which protruded from the concretion. Another piece of oyster shell was found loose in the appendix. These pieces of shell were, approximately, the size of the head of a pin, flattened to a thin plate. The pain became severe about 3.30 in the morning, and the operation was performed the same evening. The patient was my wife, and while she was bombarded with both shot and shell, I am most happy to state that the case is progressing favorably. I need hardly say that the operation was not performed by myself, as I believe no surgeon should operate on his own wife.

DR. SOLON MARKS, Milwaukee.

I have had several cases in which shot were found in the bladder, and in one, shell. One patient has had a discharging wound for

twenty years, but at the present time she is better than she has been for a long time. Shot have been found off and on in the discharges. There is more or less discharge through the bladder every day. Another case I operated on died promptly, there being two or three places where there were openings in the abdominal wall.

REPORT OF FORWARD DISLOCATION OF THE FIFTH CERVICAL VERTEBRA.

By SOLON MARKS, M.D.,
MILWAUKEE, WIS.

JANUARY 21, 1895, I was called to see Mrs. H., of Wauwatosa, in consultation with Dr. Morehouse. I was told by the doctor that Mrs. H. was a lady sixty-five years of age, weight about 140 pounds, who on the evening of January 17th, while about to descend a flight of stairs in the dark, and when upon the top step, lost her footing and fell head first to the bottom. The noise made in her fall attracted the attention of her husband and other members of the household, who rushed to the door leading to the stairs, where she was found with her head wedged in between the door and partition, her feet resting upon the lower step of the stairs. She was semi-conscious. When she was extricated from her perilous position it was found that her right arm and leg were completely paralyzed; left arm and leg partially paralyzed. Over the right side of the head there was a large swelling, also one upon the left; in short, there were bruises on all parts of the head. In a short time after the fall she vomited more or less blood. Paralysis on the left side increased, and in the course of a few hours became complete. There seemed to be paralysis of motion in all muscles below the neck.

When I entered the patient's room she was seated in a rocking-chair, well tipped back, and kept in position by sticks of wood placed under the forepart of the rockers. Her head was thrown back, supported by pillows, and her face turned upward. The forepart of the neck protruded forward, rendering it convex, making the larynx abnormally prominent. The integument in that region was tense. Her head was permanently fixed; any effort to move it caused excruciating pain.

Upon examination, I found a sharp angle at the posterior part of

the neck, as near as I could determine, at the fifth cervical vertebra, and in tracing the line of the spinous processes it was suddenly lost at that point, the integument being thrown into folds. There was difficulty in swallowing, every attempt being followed by violent paroxysms of coughing and choking. There was also more or less difficulty in breathing. Bladder and bowels completely paralyzed. At times she was delirious, and thought she was lying on nails and nuts, and asked to have them removed.

As her head was permanently fixed and was not directed to either side, I did not think it probable that there was a fracture, and gave it, as my opinion, that there was a bilateral dislocation of the fifth cervical vertebra forward, and advised that an effort be made to restore the bone to its normal position, pointing out, as best I could, the dangers attending such effort, and also explained to her friends the probable consequences of its being allowed to remain where it was, providing she survived the injury. When I left, late that evening, the patient, her husband, and friends had the matter under consideration, and seemed to think they would have an effort made the next day, and, if so, would telegraph for me.

To my surprise I did not hear anything more from the case until the next June, some five months later, when I was called to see her the second time. It was then I learned that a physician, a specialist, called the morning after my first visit, and frightened the patient and her friends by telling them that any attempt to reduce the bone would be almost certain death, and that in a short time she would be very comfortable if the bone was allowed to remain where it was. He further said that reduction would not benefit her condition, as paralysis would continue the same. If the doctor gave the advice he is credited with, it is not strange that the patient concluded not to submit to an operation attended with so much danger to life, if she was not to be benefited, especially as she was to be quite comfortable in the course of a few weeks.

At this, my second visit, I found her very much emaciated, exceedingly weak, with a bed-sore over the sacrum three inches in length by two in width, extending to the bone. There were smaller ones at other points, and the greatest care had to be exercised to prevent sores at every bony prominence. Bladder and bowels completely paralyzed, necessitating the use of the catheter, contents of the rectum being removed by digital exploration. By a great effort on her part she

could barely move the fingers of her left hand, also the toes of the left foot.

I did not see her again until December, 1898, over three years later, when, being in her neighborhood, I called and found her dressed and seated in her rolling-chair. She was much more fleshy than at my former visits. The forepart of the neck was not as prominent as when first injured, neither was the face turned upward as much. She could swallow without much difficulty, raise her left hand to her head with some effort; right hand only part way. Fingers ankylosed. Some days she was able to move her feet and legs a very little.

I was informed by the nurse, a very intelligent person, that the bladder and bowels had been completely paralyzed for a period of a little over two years, after which she noticed there was incontinence of urine, the bladder soon emptying itself to such an extent that she [the nurse] discontinued the use of the catheter. The sphincter, however, is entirely powerless, the urine dribbling away, requiring great care to prevent excoriation. The bowels move without assistance. She complains of almost constant pain along the course of the left sciatic nerve. Right leg and foot swollen; left leg and foot I judge to be about the natural size. Knee-jerk slightly exaggerated on right side; left, about normal. Has general hyperæsthesia below the neck. It is claimed by the patient and nurse that there is not and never has been complete anæsthesia at any point, but the sensations have been and continue abnormal over every part of the body below the injury. Muscles of the legs, the only ones I have had an opportunity of testing, respond to the faradic current. At times she says "the sensations are the same as a foot being asleep;" at other times "the same as when a person strikes the crazy bone;" she alludes to striking the ulna nerve at the elbow. She tells me that her life since the injury has been one of perfect torture—that she has not had a comfortable moment during her waking hours since the accident. She has to be dressed, carried to and from the bed like an infant, and, as she weighs about 140 pounds, it is no small undertaking, requiring two strong persons.

Notwithstanding her condition, the slight return of motion in her arms and legs leads her to hope and feel quite confident that sooner or later she may be able to walk. No doubt this hope has much to do in preventing her from becoming entirely discouraged. As there was only partial paralysis of the left side immediately after the acci-

dent, becoming complete in the course of a few hours, it is probable that there was hemorrhage in or around the cord at the point of injury, increasing the pressure until the motor tracts of the cord were cut off from brain impulses.

The slight return of motion in the limbs shows that by absorption the pressure upon the cord has been somewhat diminished. From the fact that the knee jerk is present and the muscles firm, I conclude that the trophic cells are not destroyed. The slight motion returning in the extremities shows that the motor tracts are not entirely cut off from brain impulses, as they were shortly after the injury.

WOUND OF THE URINARY TRACT DURING AN OPERATION FOR ACUTE APPENDICITIS—SPONTANEOUS CLOSURE OF URINARY FISTULA—RECOVERY.

By CHARLES A. POWERS, M.D.,
DENVER, COL.

On September 29, 1898, I was asked by Dr. A. A. Clough, of Denver, to see W. D., a young man, aged eighteen years, whose history was as follows: Six months previous he had had an acute attack of appendicitis which lasted three days. Local pain of a "grumbling" character, constipation, and general indisposition followed. These had been fairly constant ever since.

The present attack began at noon on September 22d with the ordinary symptoms of sharp pain in the umbilical region, vomiting, and fever. The bowels were freely moved by salines. On the following day, September 23d, the temperature was 104° and the pulse 112, the entire abdomen tender and painful. The symptoms gradually subsided. On September 25th the temperature and pulse were normal, while the pain and local tenderness had almost completely disappeared. On the 27th the patient was out and about, although he felt a bit ill. On the 28th the pain reappeared, and the patient vomited profusely several times.

He was seen by me in consultation with Dr. Clough at 5 P.M. on September 29th, seven days after the onset of the present attack. At this time the temperature was 101°, the pulse 100. There was moderate tenderness in the right iliac fossa on deep pressure. The abdomen was flat, and not rigid. There was an elongated, rather tender mass, the size of one's thumb, at the outer border of the right rectus muscle, below a line drawn between the anterior superior spine and the umbilicus. The bowels were well moved by repeated rectal injections.

The following morning, that of September 30th, the temperature was 100°; pulse, 108; the local tenderness had somewhat increased.

Operation at St. Luke's Hospital at 11 A.M., with the assistance of Dr. Clough, Dr. J. M. Perkins and the members of the house staff. Ether; the ordinary incision was made at the outer border of the rectus, the general peritoneal cavity entered, and carefully and thoroughly walled off. The cæcum was recognized with some difficulty. The tumor felt through the abdominal wall was a hard mass of inflamed omentum and small intestine densely bound together by old, firm adhesions. In the depth of this the appendix was afterward found. With some difficulty the base of the cæcum was turned up and the beginning of an enlarged and inflamed appendix discovered. This was slowly traced through dense old adhesions downward into the pelvis. The small intestines were bound in a mass by firm adhesions, and it was with great difficulty that the finger found its way along the appendix, boring a hole among the intestines downward into the pelvis, where it could be hooked around the tip of the appendix and the appendix itself liberated and worked up into a free position. As the finger brought the appendix up out of the pelvis, between the adherent loops of small intestines, a gush of straw-colored fluid (two ounces or so in amount) followed, and the same fluid welled up throughout the operation. A small quantity of this fluid was collected and found to contain urea.

The general cavity was further protected, and the appendix, which was four inches long, friable, and gangrenous at three points, quickly excised. An attempt was made to locate the source of the urine through the opening between the small intestines, through which it welled up, but this was not successful. As has been said, the adhesions binding these intestines were very firm and dense, and it was thought unwise to persist. A catheter introduced through the urethra drew a moderate amount of urine, which was not bloody. A measured amount of fluid injected into the bladder came back in practically the amount introduced.

The operation wound was well packed and an incision made in the median line just above the pubes. Through this the bladder was hastily examined. No wound was found. It was not possible to examine the right ureter because of the densely adherent intestines.

The median incision was closed except at the lower angle, where a small strip of gauze was introduced behind the bladder. The operation field on the right side was well washed and a glass drain introduced into the pelvis at the opening, through which the appendix had

been withdrawn. A further glass drain was placed at the upper angle of the wound to the inner side of the cæcum, and the remainder of the wound thoroughly packed with 3 per cent. iodoform gauze. Time of operation, two and one-half hours.

The patient's condition at the close was fairly good. He was placed in bed on his right side, with the head of the bed elevated about two feet.

The first forty-eight hours were stormy. The patient was very restless and in much pain. There was a profuse discharge of urine through the wound. That passed by the urethra was about twenty ounces daily. The latter was at no time bloody. After the end of forty-eight hours the bowels had been well moved, and the urine coming through the wound began to diminish. On the fifth day the urinary fistula seemed to be closed. The tubes and gauze were gradually withdrawn and the patient made a complete recovery, the wound being firmly healed at the end of six weeks. He has since remained entirely well.

A thorough search through literature, in which I have had the kind assistance of Dr. Edward Preble, of New York, fails to show record of a case similar to the foregoing, and I feel it but just to publish the account as a warning of what may happen under similar circumstances.

It seems probable that the urinary wound was of the ureter. It is quite possible that the appendix was adherent to it, and that opposite a gangrenous patch in the appendix contiguous ulceration of the ureter had taken place. The ureter was not torn entirely across, or such prompt cessation of the urinary flow would not have occurred. I cannot reproach myself with undue haste or roughness in digging the appendix out, and I can but think it wise that prolonged search was not made for the urinary opening.

At last year's meeting of this Association both Keen and Fowler presented interesting histories of cases in which the appendix had become adherent to the bladder, perforation having taken place. I regret my inability to find further literature bearing on the subject.

MIXED SARCOMA OF THE PONS VAROLII.

BY STEPHEN H. WEEKS, M.D.,
PORTLAND, MAINE.

MASTER H. C.; residence, Machias, Me.; aged sixteen years; previous to his injury was perfectly well; born of healthy parents; was injured in the latter part of February, 1897, by colliding with a passing team while coasting. He thinks he was thrown from his sled; the runner of his sled struck him on the left side of the head a little posterior to the parietal eminence. While he was somewhat stunned he was not rendered unconscious, and the wound in the scalp was slight, not bleeding enough to soil his coat. The wound was dressed by a physician, and he was not confined to the house at all, though he suffered considerable pain in his head. In two or three weeks after the injury he commenced to have double vision. Objects of considerable size would not be separated, but would blend one image with the other, and one was a little higher than the other. The images of small objects were entirely distinct. The parents, thinking the trouble was entirely in his eyes, came to Portland on March 25th, about six weeks after his injury, to see an oculist, Dr. Willis B. Moulton.

At this time he had headache, some vomiting, and double vision. Examination showed hyperphoria of right eye five degrees, exorphoria of right eye two degrees. The last of April the double vision had disappeared; his headaches had so much improved that the parents returned home, taking the patient with them.

In the early part of June he became worse, and the parents returned for further treatment. At this time Dr. Moulton found paresis of all the external ocular muscles, double vision about the same as at the first visit; his headaches and vomiting were prominent symptoms. About the middle of June, Dr. Moulton asked me to take charge of the

case. I found him suffering much pain in the head, being referred to the back of the head and over the eyes. Vomiting occurred frequently, especially in the morning. There was great constipation of the bowels, requiring three compound cathartic pills at bedtime, a bottle of solution of citrate of magnesia in the morning, and later on in the day an enema.

The pulse was slow, varying from 40 to 60 per minute. There was no elevation of temperature. He had no difficulty in walking, no difficulty in the use of his hands, no muscles involved, excepting the ocular.

His sleep was quiet and undisturbed, as a rule. His tongue was thickly coated with a whitish fur; his breath was foul. He had no appetite and was able to take but little nourishment, and that in the liquid form.

This condition continued about two weeks, when his hearing began to be affected, and he gradually grew quite deaf. There was considerable hebetude and slowness of speech, but his intellect was unimpaired. He would reason intelligently and answer questions correctly, if time enough was given him. The pupils were somewhat contracted, but not unequal in size, and his sight was undisturbed.

About the first of July optic neuritis appeared, and continued until death. About this time leeches were applied to the temples, which relieved the headache very much. He was able to bear such medicines as the solution of hypophosphite of lime and soda and syrup of hydriodic acid. Cathartics were required to move the bowels. About July 17th he sank into a stupor, from which he never rallied; all the muscles were relaxed and limp, and the only movements were those of circulation and respiration. The parents told me that for about two weeks before death, when they would get him up, there would be sudden and spasmodic elevations of the shoulder, especially the right one. At one time, two or three days before death, while I was sitting by the bed, I noticed a spasmodic contraction of the pronators and flexor muscles of the forearms and flexors of the fingers. The last forty-eight hours of his life there was elevation of temperature, at one time 104° in the axilla. He died at 3 o'clock A.M., July 19th. The last two hours were full of apparent sufferings—loud groans, spasmodic contractions of the muscles of the right shoulder, lower jaw greatly depressed, opening the mouth widely, and all his symptoms were frightful to those around.

July 19, 1897. Post-mortem examination on the body of H. C., made about eight hours after death. Rigor mortis well marked. Blood had settled about the back of the head, extending up to and including the back parts of the ears, the skin being very dark from the settling of the blood. The undertaker said he had withdrawn thirty-two ounces of blood from the body and had injected sixty-four ounces of preserving fluid. The face was pale and calm. Pupils were dilated, the right pupil was much more dilated than the left, nearly twice as large. On removing the calvarium and exposing the top of the brain the meningeal vessels were found much distended. The superior longitudinal sinus was much distended; just to the left of the sinus about three inches from the crista galli the dura was elevated, and presented the appearance of a small cyst beneath the dura mater. This was small, about as large as a shelled almond. In the median line, on each side of the superior longitudinal sinus, a little in front of the bregma, was a discoloration and elevation of the dura, about one and a half inches in diameter, cyst-like in its formation, of a milky-white color, streaked with blue veins running across its surface. The lobes of the cerebellum were more prominent than normal.

The dura was opened by cutting along from before backward, on each side of the superior longitudinal sinus from the crista galli back as far as the attachment of the falx cerebri to the tentorium cerebelli. The falx was divided just posterior to the crista galli, and the brain lifted from the anterior fossa of the skull, the nerves divided as far back as the middle fossa, where the attachment of the tentorium cerebelli to the superior border of the petrous portion of the temporal bone was divided, allowing the middle lobes of the cerebrum and the cerebellum to be lifted from the middle and posterior fossæ of the skull. The spinal cord was divided as low down as possible, and the entire brain was removed from the dura mater and its reflections. The dura mater was closely adherent to the mass above described, situated on each side of the superior longitudinal sinus in front of the bregma, and it was also adherent to the margin of each cerebral hemisphere for about three inches, and when removed the margins were covered with a layer of lymph, whitish in color. Except at these places the surface of the brain seemed normal. The amount of cerebro-spinal fluid which escaped in removing the brain was estimated to be about six ounces.

On lifting the posterior lobes of the cerebrum from the superior

surface of the cerebellum there was seen a dark colored (almost black) prominence projecting from the upper surface of the pons Varolii, and occupying its entire upper surface. Before examining the mass any further, sections of the brain were made, exposing the centrum ovale minus and majus. The brain substance as exposed by these sections was found perfectly normal. The lateral ventricles were normal, but entirely empty, and choroid plexus very small. After the examination of the brain thus far we turned our attention to the mass in the pons. The pia mater covering it was much distended and contained a greenish-yellow fluid to the amount of about a drachm. On separating the pia from the mass I was able to enucleate it from its bed, and it was found to be a tumor, one and three-fourths inch in one diameter, one and a half inch in another diameter, and seventh-eighths of an inch thick, and weighing 312 grains. This tumor did not blend with the substance of the pons, but was easily enucleated from it, leaving a perfectly smooth surface or bed. This had seemed to press upon and close the aqueduct of Sylvius or the canal connecting the third and fourth ventricles. Various sections were made through the cerebrum and cerebellum, and the brain substance was found perfectly normal.

A peculiar feature, one very noticeable, was the absence of cerebro-spinal fluid from the lateral and third ventricles. There was not a drop of fluid in either of them, and the choroid plexus in each lateral ventricle was very small—in fact, so small as to be quite indistinct.

A microscopical examination of the tumor showed it to be a mixed sarcoma, containing round, fusiform, and giant cells, with very little stroma.

I have no doubt the blow which the boy received caused a rupture of small vessels at this point, and the blood which escaped formed the nucleus of the tumor.

Microscopical examination made by Dr. Charles D. Smith, July 24, 1897:

1. The fragment tumor. Sections show a growth which is mixed sarcoma. There is almost no stroma except in a few areas. There are a few delicate fibres forming alveoli filled with large mononuclear cells. The mass of the tissue is made up of large and small round cells, numerous spindle cells, and a few giant cells. There are also many cells of irregular outline, some of them with processes. In and about many of the cells are pigmented areas of black color. The

growth is exceedingly vascular and contains much extravasated blood, and many of the vessels are filled with closely packed corpuscles.

2. The fragment of dura. I am unable to demonstrate in it anything more than a condition of inflammatory thickening. Examination for tuberculous tissue or tubercle bacilli was unsuccessful. The tissue is much thickened and infiltrated.

FORCIBLE CORRECTION. SPINAL CARIES.

By E. H. BRADFORD, M.D.,
AND
ROBERT H. VOSE, M.D.,
BOSTON.

The plan of straightening the curve in Pott's disease by force has now been sufficiently before the medical profession, with renewed attention in the past few years, to justify an attempt at a critical survey of the procedure. It is proper that it should be considered, both from a pathological and a clinical point of view; if the subject be looked at from a pathological point of view, it would seem as if the clinical application of the method would be limited to certain conditions.

The curvature in Pott's disease, like every other affection, varies in the stages of its development. In cases of complete osseous ankylosis (as in cured cases of Pott's disease where recovery has taken place, except as far as deformity is concerned) it would seem to be unsurgical to attempt to straighten it, the proposal to make a wedge-shaped resection of the spinal column not being sufficiently reasonable to warrant acceptance.

The other conditions of Pott's disease vary from that of commencement of inflammation with a small carious focus to a large and extensive destruction of the bone, varying also with the extent of the ossifying ostitis and its preponderance over the destructive ostitis. Where the ossifying ostitis is more extensive than the destructive ostitis, operative methods become proportionally less desirable than where the destructive ostitis leaves the spine more movable.

The existence or absence of an abscess is also of importance.

Where the front of the spine is surrounded by suppuration, it is manifest that ill-considered forcible straightening would be followed by danger.

It would, therefore, be inferred that in certain instances a rectification would be unjustifiable; in some, it would be attended with danger; in others, the relief of the superimposed pressure or force crowding inflamed bony tissues together would be followed by relief. That this represents the actual results from the procedure of straightening of the spinal column is shown by the accompanying statistics compiled by Dr. Vose:

ANALYSIS OF 610 CASES REPORTED BY 29 OPERATORS.

Length of time elapsed varies from two days to two and a half years.

In separately detailed cases, 7 were more than 1 year old.
" " " " 35 " " " 6 months old.
" " " " 25 " " " 3 " "
" " " " 20 were less " 3 " "

Death reported from all causes		21
Meningitis	5	
General tuberculosis	4	
Trauma of the operation	4	
Intercurrent disease	3	
Unstated	5	
Autopsies: All showed a considerable local trauma.		
No case showed effectual effort at repair (one being 2½ years subsequent to correction).		
Immediate dangers:		
Respiratory embarrassment	7 cases.	
Pain	6 "	
Shock (severe)	2 "	
Indirect effect:		
Abscess reported present before the operation	18 cases.	
Ruptured	4	
Benefited or absorbed	5	
Appeared subsequently	2 cases.	
Paralysis:		
Present before the operation	31 cases.	
Relieved (complete or partially)	17	
Not relieved	2	
Not stated	8	
Appeared (partial only)	4	
General condition:		
Reported distinctly improved	7 cases.	
Direct effect on deformity at time of operation stated in	229 cases.	
Complete correction	119	
Incomplete correction	94	
No gain	16	

Result three months later (cases with some gain) . .	66 cases.
No relapse	17
Some relapse	44
Total relapse	5

Two questions suggest themselves, the first, how much force is needed in this procedure; and, second, the best means of applying the force. The amount of force required depends upon what is attempted. If it is desired to break up any ossification a great deal of force would be necessary; where the amount of cicatrizing ostitis is slight, slight force is required. It is manifest that the less force the less the danger; as, also, the less force the less the discomfort which the patient suffers. When force is used at a mechanical advantage, less violence will be needed for the required correction. It is for this reason that the plan which has been in use at the Boston Children's Hospital for the past two years will be found to have certain advantages. In this but little force is employed, and that well under control; the diseased projection is used as the central resistant point, and the weight of the trunk on each side of this point acts as a straightening force. The appliance by which this correction can be done is as follows: An upright which can be raised or lowered by an adjustable screw is furnished with a steel top having tips so arranged as to steady a zinc plate equipped with holes arranged so as to press at each side of the vertebral spines. If these plates are padded and placed beneath the patient in such a way that they will lie on each side of the spines at the point of the projection, an upward pressure can be exerted by raising the upright by means of the screw attachment. If this is raised to such a height that the head and pelvis hang from a suspended trunk, it is manifest that a strong force is exerted to straighten the spine and correct the curve. This can be increased, if necessary, by a traction force upon the limbs or upon the head and shoulders. Such a force, however, will not be needed unless great violence should be required, which seems never justifiable. The amount of force is regulated by the amount by which the upright is raised. This method was first suggested by Dr. Metzger, an interne of

the Children's Hospital. It was subsequently modified by Dr. Goldthwait, who placed steel bars to lie close to the spine, as a means of correcting lordosis; he employed the method with great success, and attached the uprights to an oblong frame, using cross bars and straps as a support for the trunk. The unusually successful cases reported by Dr. Goldthwait before the Orthopedic Association warrant the assertion that the method is equally successful as that requiring the employment of great force. It will be found that the patient suffers but little discomfort, that the jacket can be applied readily, and in practice no anæsthetic is used, as it has been found that sufficient force can be applied without discomfort, and it is believed that force greater than this would be dangerous. When the disease is seated in the upper dorsal region it is manifest that some head support is required, and this can be furnished by placing a stiffened leather, padded with felt, about the neck, and including this in the plaster jacket, which passes above the shoulder. Instead of this the various forms of head support can be applied to the jacket, or the whole head may be included in the plaster bandage where mechanical appliances cannot be readily retained. It is advisable that where this method is employed repeated jackets should be applied and a gradual correction obtained in preference to the employment of a great deal of force at one sitting. The amount of correction obtained at each sitting, or after a number of sittings, will depend necessarily upon the pathological conditions, the complete straightening being possible but not practicable in all cases.

It is evident that no less importance is to be placed upon the retention of a corrected spine than upon the correction itself, for where a cure depends upon a cicatricial ostitis solidifying the weakened and inflamed tissues which have replaced the normal bone, the tendency to a contraction of cicatrizing tissues before ossification has taken place will tend to reproduce the curve even if thoroughly corrected. As the process of ossification of cicatrizing ostitis is not a rapid one, it is manifest that protection and retention will be required for some time, and the problem of the proper appliance is not a simple one, as the

apparatus must be worn for months and even years. A discussion as to the proper apparatus for after-treatment is not the object of this paper. It can be said, however, that nothing is equal to a properly applied plaster jacket in the stages following correction. In the subsequent years other appliances, removable jackets, or apparatus are manifestly preferable. It will, therefore, appear that the use of forcible correction in Pott's disease is somewhat more limited than was at first supposed: first, by the judicious selection of cases; and, second, by the number of cases where the after-treatment can be properly carried out, for it is manifestly absurd to straighten a spinal column, exposing the patient to a certain amount of risk, and, later, to allow the patient to relapse into a condition as bad as before the operation. The directions for the selection of cases given by various writers on the subject would seem to be judicious. It is manifest from the cases reported by Goldthwait that improvement in paralysis in properly selected cases follows this procedure, and it is believed it can be done without danger, provided ordinary judgment is used. It is believed that the method herein described diminishes the danger.

It would appear, therefore, that in the management of a case of caries of the spine, the surgeon, if the patient is presented in an early stage, can prevent the development of the deformity in the region below the upper dorsal; that where a curve has taken place in this region correction can be made with safety, unless the cicatrizing ostitis has developed to a point where great force is necessary and a practical fracture of the spine required. It is believed that no anæsthetic is necessary if cases where the procedure is likely to be beneficial are the ones subjected to the treatment. It is clear that by judicious after-treatment a relapse of the curve can be prevented in many instances, but this after-treatment requires attention for years.

A simpler and no less efficient way of straightening a curved spine, where the method is applicable, may be described as follows: The patient is placed on his back on any table; a sling made of sufficiently firm cloth, and a few inches in width, is passed under the child at the greatest prominence of the pro-

jection. Between this and the skin a thick layer of saddler's felt is placed (a hole can be cut out in the felt, or later in the jacket, to protect the spinous processes). This sling should pass upward on both sides of the patient, reaching to a cross-bar

FIG. 1.

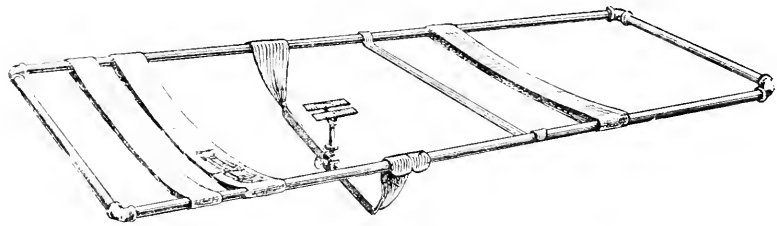
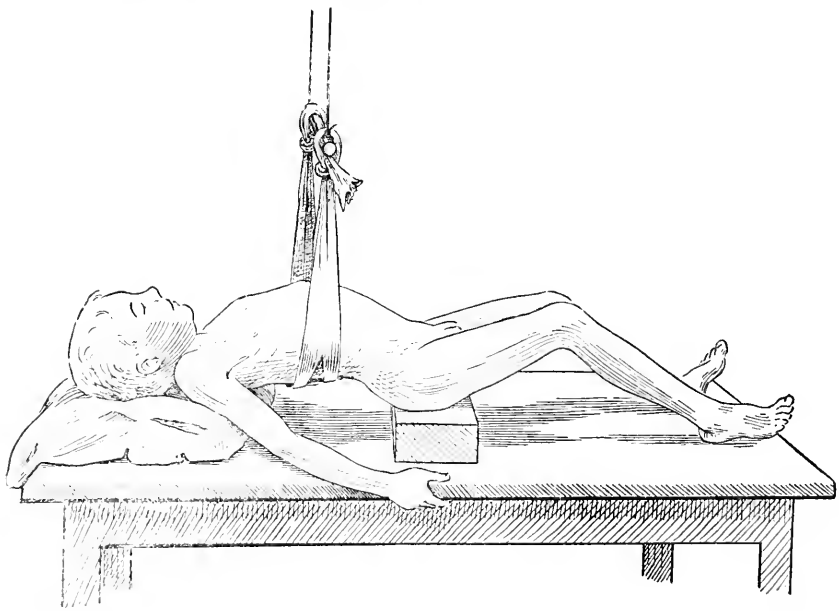


FIG. 2



similar to that used in the ordinary Sayre suspension, and sufficiently wide to keep the ends of the sling from crowding the patient's ribs. The cross-bar can be attached to a pulley above the patient, and by raising the cross-bar the patient is raised at the point at which it is desirable that the projection should be

corrected. The patient can be raised so that the weight of the whole trunk acts as a correcting force, and if necessary downward pressure or a downward pull can be exerted upon the pelvis and upon the shoulders, or downward counter traction can be used upon the arms, head, and shoulders, and in this way all requisite force may be used. If the patient is raised partially from the table, and a pillow or sand bag placed under the head, the trunk will be found sufficiently raised to enable the surgeon to apply plaster rollers in the ordinary way. The plaster bandages can be applied around the sling, and the sling cut off at the place of emergence of the bandages, leaving but a slight opening. This can be covered by an extra layer of bandage, making the jacket perfectly secure.

The advantages of this method are chiefly in its simplicity and its ready use without any complicated apparatus. In fact, a broomstick or bar resting on two high pieces of furniture, and strong bandages or cloth as a sling and a piece of felt would be all that would be necessary in the application of a correcting plaster jacket by any surgeon of skill and experience.

It can be emphasized that it is the opinion of the writer that forcible correction of Pott's disease is a term which should not be applied to a method which can, if judiciously used in suitable cases, be efficient. No anæsthetic is necessary in suitable cases in a method which may be called the rectification of the curve of Pott's disease.

CASES OF INJURY TO THE SKULL, FOLLOWED BY RECOVERY.

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It is a source of regret in reporting the following cases that it is not possible to give with greater accuracy every detail in each case. Unfortunately some of the notes are incomplete, the record not having been so full as it should have been. There are, however, many points of interest. In beginning this paper it was my intention to confine it to a report of cases of fracture at the base of the skull, with recovery. One case, in which there was no involvement of the base, has been added. All other fractures have been omitted. The evidences of fracture at the base of the skull may possibly be considered as inadequate in one or two cases. It is possible that deafness or paralysis of certain nerves of the face may result from injury to the head without the occurrence of fracture, and hemorrhage from the ear may take place without injury to the internal table of the skull. Careful observation of the cases reported has led me to conclude, however, that the symptoms observed in the cases reported are best explained upon the supposition that fracture occurred. It is also interesting to note that in addition to hemorrhage in one or both ears there are instances of deafness, loss of smell, and also of a slight degree of optic neuritis. All of the cases reported have recovered, and the majority of them have been observed for several years after the receipt of the injury.

In a portion of the cases in which bleeding from the ears occurred there was also an escape of what was supposed to be

cerebro-spinal fluid, but, unfortunately, the records concerning this are not sufficiently accurate to warrant me in reporting it, and thus it has been omitted. In reporting the loss of smell following the injury in several cases it may be interesting to record another observation—viz., that of a patient who had a deviation of the nasal septum to the right side. The septum was forcibly straightened and held in place by rubber drainage tubes inserted in either nostril. Soon after the operation the patient discovered that he was aware of the sense of the perfume of flowers and other delicate odors. Previous to the operation he had never recognized their existence.

Why the cases reported recovered while others, to all appearances no more seriously injured, died, I cannot determine, nor am I able to draw any deductions as to what special line of treatment will enable the surgeon to avoid the dangers of infection and consequent meningitis. It does not seem possible to render injuries to the base of the skull communicating with the nose and ears sterile.

CASE I.—J. K., male, aged fifty-one years; had always been well and strong. On January 1, 1892, he was knocked down by a motor car. From what I ascertained, I concluded that when he fell his head struck upon the pavement directly upon the occipital protuberance. He was rendered unconscious by the fall, but regained consciousness in a few moments. He was carried into a drug store, but says that he heard the ambulance drive up, and gave orders that he should be taken home. Instead he was taken to Lakeside Hospital, where I saw him. He was able to stand, could talk, and his mind seemed clear. He was, however, absolutely deaf. I gave him pencil and paper and he wrote his name and address, and complained of being dizzy. There was a V-shaped scalp wound over the occipital protuberance, and there was also some blood in both ears. The wound was carefully examined, but no fracture of the skull could be found, and the wound was dressed antiseptically and the patient was placed in bed with ice bags to his head. On the second day the patient could hear very loud talking. On the third day the ears were examined by Dr. Millikin, and both tympanic membranes were found to be congested. The patient was kept in bed with absolute quiet until shortly before leaving the

hospital, on January 25th. At this time he still complained of being dizzy, but could hear moderately well. On June 15th I saw the patient in my office. He still complained somewhat of dizziness, and told me that he heard nothing whatever with his left ear. At that time Dr. Millikin again examined the ears and found the tympanum of the left ear to present a parchment-like appearance with no light reflex. The right tympanum was dull in color, having slight light reflex. Both right and left tympanic membranes were retracted.

I saw the patient again on April 5, 1899, and at that time made the following notes: He says that on leaving the hospital he had no hearing whatever in his left ear, but his hearing was good in the right. It continued good in the right until April, 1896. When working in his cellar one day he took a severe cold, and this was followed by deafness. He was treated for catarrh, but with little benefit. Twice for short intervals and again for an hour or so his hearing was restored to its original condition, but the improvement ceased immediately, and now he hears only very loud conversation. Before his injury he says his hearing was most acute. The same was true with reference to his sense of smell. Since his injury he has very little sense of smell, and can distinguish only with difficulty what he is eating. He says that he is scarcely able to tell when he is eating onions. Examination of the ears shows the external meatus of the right rather small, the membrane very much retracted, of a ground-glass appearance, and almost no light reflex. The left shows the same general appearance. The loss of hearing in this case may possibly have resulted from hemorrhage into the internal ear without fracture of the skull, and it is impossible, of course, definitely to determine the exact injury. Though hemorrhage was doubtless a factor in producing the deafness, it seems probable that the hemorrhage resulted from fracture rather than that deafness in both ears should have resulted at the same time from hemorrhage without fracture.

Case II.—W. M. M., male, aged thirty-two years; had always been well and strong. Was injured on November 28, 1892, by being thrown from a carriage, but whether his head struck the pavement or a companion riding with him fell upon his head is not known. He was picked up unconscious and carried to Charity Hospital, where I saw him shortly after the injury. There was an incised wound over the occipital protuberance. He bled freely from his right ear. The wound was laid open and the skull carefully examined, but no fracture was

found. The patient was injured at 6 P.M., and he complained of pain when the wound was laid open, which was done without an anæsthetic, but showed no other signs of consciousness until 6 o'clock the next morning, when he asked what bells were ringing and also where he was. The patient developed high fever after the injury, the temperature rising to between 105° and 106°. He was able to answer questions rationally, and although he recognized people, he seemed to have no realization of their relationship to himself for about three weeks. After this time his mental faculties began to be clearer, and he regained them perfectly. Some two weeks after the accident it was noticed that there was paralysis of the right side of the face. This doubtless had occurred sometime before it was observed, but as the right side of the head was thoroughly enveloped in dressings it was not noticed. The paralysis of the face remained complete for a long time. For a year he was much troubled in keeping the food between his teeth and the cheek on the right side. There was inability to close the right eye and marked ectropion of the lower lid for nearly two years, after which time the ectropion disappeared. He cannot lift the lower lid and can only close the upper lid over about one-third of the eyeball. There was no impairment of sensation at any time, and the taste and smell remained intact. He has never suffered from dizziness, but for a considerable time he had severe headache over the vertex of the skull, but at no time was there any at the base. The movement of the eyeballs is perfect and the sight is excellent. There is no paralysis of either tongue or pharynx. He is absolutely deaf in the right ear. The right side of the face remains entirely paralyzed and expressionless, and the mouth is drawn markedly to the left side. The patient's health at the present time (May, 1899) is excellent, and he is actively engaged in business as the purchasing agent of a large company.

CASE III.—J. E. E., female, aged forty years. Had always been well and healthy. On November 5, 1898, while crossing the street was knocked down by a wagon. She was struck upon the right side and fell upon her left side, probably striking her head upon the pavement. She was unconscious, however, and knows nothing further about it. She was taken at once to Lakeside Hospital, where I saw her soon after her admission. At that time she was conscious, there was no paralysis of any sort, the pupils were clear and responded to light. The only serious symptom was the free discharge of blood

from the left ear. The patient was placed in bed with ice-bags to the head, her bowels were emptied, and she was kept quiet and in a dark room. She expectorated some blood, and some blood also flowed from the nose, and she complained of severe headache. The next day she complained of nausea and dizziness. The bleeding from the ear had ceased, but she continued to expectorate blood and to bleed from the nose. These both ceased on the following day. On the 8th she complained of twitching of the left eye and inability to close it. There was also noticed paralysis of the left side of the face. The ice-bags were continued until November 13th, until which time she still complained of some dizziness. The paralysis of the left side of the face was complete. The patient remained in the hospital until December 13th. At that time there had begun to be a little improvement in the condition of the face. On March 4th I examined the patient, and whereas I found the hearing in the right ear normal, the patient hearing the watch at a distance of fifteen inches, on the left side she only heard the watch when held closely over the ear. She heard it still more distinctly when it was placed against the mastoid. The paralysis of the face, which three weeks before was still noticeable, had entirely disappeared, the right tympanum was normal, but the left was markedly retracted. The patient says that she notices no difference in her sense of smell. On March 29th her eyes were examined by Dr. Millikin. The vision in both eyes is 6/VI, being a little better in the left than in the right. Examination under a mydriatic showed hypermetropic astigmatism of both eyes. The ophthalmoscopic examination of the right eye showed striations running into the retina from the disk, a condition which awakened a suspicion of a moderate degree of optic neuritis. The left eye showed the same condition in less degree. The field of both eyes was good for objects, but for red and green was constricted. Other than a low grade of neuritis, especially marked in the right eye and deafness in the left ear, there is no evidence of any remaining disturbance.

CASE IV.—A young colored man, aged about twenty-five years. Unfortunately the history of this patient has been lost. In a quarrel he was struck with the head of a hatchet, the blow being upon the level of the ear and about one-third of the distance from the ear to the occipital protubrance on the right side. The patient was brought to Lakeside Hospital shortly after the accident. He was bleeding profusely from his right ear and was in a dazed and semi-conscious

condition. The wound was enlarged and there was a small indentation of the occipital bone. This seemed, however, to be confined to the external table, so that the skull was not trephined. There was no injury to the external ear itself, so that it seemed probable that the injury to the external table of the skull had been associated with a fracture of the vitreous portion of the temporal bone, which had resulted in hemorrhage from the ear. The patient made a rapid recovery and was dismissed from the hospital, and I have been unable to get any further record of the case.

CASE V.—O. K. M., male, aged forty-two years. General health had always been excellent. On January 7, 1899, he was struck by a pine block falling upon his head, a distance of fifty feet. He did not come under my care until about four weeks after he was injured. The history of the case is as follows: The patient bled profusely from both ears and nose and vomited large quantities of blood. There was also an effusion of blood beneath the conjunctiva of both eyes, the right eye becoming greatly swollen, so that it was closed for several days. There was later discoloration in front of and below both ears, which continued for two weeks. The patient was unconscious for seventy-two hours. After this consciousness gradually returned, and he sat up February 1st. He reached home February 6th. I saw him first on February 6th at 4.15 P. M. I found him lying in bed in a perfectly conscious condition. He was able to move both arms and legs and grasp my hand with normal firmness with both his hands. Sensation over the entire body was normal, the patella reflexes of both legs were equal, but seemingly somewhat exaggerated. The patient protruded the tongue in a straight line. Both pupils responded to light, and the motion of the eyes was perfect. He closed both lids, but when told to open his eyes widely the left lid was raised further than the right. Pressure on the skull showed slight tenderness in the right parietal region. Pushing the head downward with the hand upon the vertex of the skull caused no pain. There was no evidence of paralysis of the muscles of the face. The patient heard my watch with the left ear at a distance of two inches. He did not hear it so well when placed upon the mastoid process. With the right ear he heard the watch at a distance of four inches, but heard it less distinctly upon the mastoid process. There was occasional slight ringing in the ears, but nothing marked. Patient says that at one time he had a feeling as though the right side of the face was asleep. When he sits up he

feels somewhat dizzy, and says upon questioning that he has a sensation of things turning somewhat to the right, and feels like falling to the right. In other respects the patient's health seems normal. I prescribed a saturated solution of iodide of potash, and directed that he take ten minims after each meal. I told him to sit up a short time each day, but to remain in the house. He was directed to eat simple food and in moderate quantities, avoiding all rich foods and stimulants.

I saw the patient on March 6th, when he reported that he had lost his sense of smell. When this occurred he cannot tell. Examination of his eyes by Dr. Millikin showed no serious trouble. On April 3d I again examined the patient. The dizziness and headache had decreased and patient felt very well, and was permitted to go to his business.

The five cases just reported are in my judgment those of fracture at the base of the skull. They are interesting because associated with the fracture are other injuries—viz., paralysis of the facial nerve, loss of hearing, and loss of smell. In part of the cases these injuries have been permanent, while in others improvement has taken place.

CASE VI.—C. H., male, aged four years. On September 29, 1894, the patient fell from a second-story window into a cellar-way, striking his head upon the stone steps. When I saw him, perhaps an hour later, I found the top of the head contused and the whole vertex of the skull sunken and irregular in outline. The head was shaved, disinfected and a transverse incision was made across the top of the skull. The vertex of the skull was found fractured in numerous pieces, there was a large fissure running from the vertex downward and to the left, to about the junction of the frontal with the left temporal bone, and a second line of fracture extending from the vertex into the right temporal fossa, and a third fracture wide enough to permit the insertion of the finger running from the vertex to the right downward and backward, well to the lower extremity of the right parietal bone. In addition to the large fractured fragments there were also numerous small pieces, so that it was out of the question to remove the depressed or broken portions of the skull. To have done so would have been to lay bare the entire superior surface of the brain. After laying the scalp well back in various directions, a sharp

strong hook was used to lift the fragments of skull into place. By hooking it under successive fragments and lifting upward it became possible to restore the vertex of the skull to its original shape. After this was done the wounds were dressed antiseptically and healed by first intention. The record of temperature has unfortunately been lost. The fever, however, never rose to more than 101° and a fraction, and the progress of the case was most favorable. The patient remained unconscious for several days, after which he regained consciousness and became entirely rational. His improvement was very rapid, but as a matter of safety the child was kept in bed between three and four weeks. I examined the patient again in March, 1899. The boy has grown and developed in every way and is perfectly healthy. He is bright intellectually, of large size, and seems in no way to have suffered any permanent damage from the injury.

This case, together with the one following, is of great interest. The injury to the vault of the cranium was most extensive, so great as markedly to deform the skull and make any operative interference seem utterly useless and hopeless. The fragments of bone were numerous, the lines of fracture were partly closed and partly widely separated. They ran from the vertex downward so far that, although not followed on account of the extensive cutting which would have been required to do so, they had every appearance of extending to the base of the skull. The sharp hook used to raise the fragments to their normal position permitted this to be accomplished with a minimum of disturbance to the bones, and completely restored the contour of the skull. The hook employed is a strong one, used for resection of bones, and is most useful in fractures of the skull, as a rule rendering the employment of a trephine unnecessary, and at the same time being much more rapid and convenient.

Case VII.—O. K., male, aged eight years. This patient was operated upon by my associate, Dr. W. H. Nevison. On July 3, 1895, he fell twenty-five to thirty feet from the top of a tree, striking the left side of his head upon stone-flagging. He vomited profusely and bled from the left ear, but there was no bleeding from the right ear. Within a short time there was so great swelling over the right eye that

the eye could not be opened. There was, however, no sign of any external violence in the region of the eye. The father said the head looked badly out of shape. The patient remained at home for three days and was then taken to Lakeside Hospital. On admission to the hospital his temperature ranged from 104° to 105°; he was wildly delirious, and had to be held in bed all of the time. This delirium lasted for about a week after the operation, but patient did not regain consciousness for two weeks. An operation was performed on the fourth day after the accident. At the time of the operation there was a bogginess over the entire left side of the skull. Through this it was impossible to feel whether or not there was any depression, but there appeared to be irregularities in the contour of the skull. An incision, beginning in the middle of the forehead just behind the hair line, was made backward and to the left, terminating at the junction of the parietal with the occipital bone. On lifting the flap from the skull the latter was found to be fractured. One fissure ran downward toward the left ear, and was traced into the temporal bone. Another extended backward across the parietal bone into the occipital bone, and the third extended across the longitudinal suture over into the right parietal bone. The trephine was placed over the left parietal bone, near the junction of the three lines of fracture, and a button of bone was removed. A rongeur was then employed, to enlarge the opening in the skull, and a bone hook was used to elevate the depressed fragments. The wound was sutured and gauze drainage introduced. The patient bore the operation well, the fever gradually subsided; he made a good recovery, and left the hospital at the end of one month. On May 17, 1899, I examined the patient. He says that he has not been able to hear well with the left ear since the accident. With the right ear he hears the watch at a distance of six inches. With the left ear he does not hear the watch at all in front of the ear, but hears it when placed on the mastoid process. The sense of smell remains normal. Examination of the eyes by Dr. B. L. Millikin shows them to be normal. There remains a depression about one inch in diameter in the left parietal bone, separated from the median line by about one-half an inch. This is firm and does not yield on pressure. It marks the point from which the bone was removed. The father says the boy is perfectly well in every way, being trustworthy and performing his work well. He goes to school, standing fairly well in everything except his reading. He is in the fourth grade when he should be in

the sixth. The father thinks he may be a little more irritable than formerly, but is easily controlled when kindly treated.

CASE VIII.—F. C., male, aged forty years; by occupation a pattern-maker. On February 8, 1899, while working at a lathe the piece on which he was working exploded and struck him in the left frontal region. He was brought to Lakeside Hospital, where I first saw him. I found a lacerated wound over the left frontal bone extending from the supraorbital ridge upward a distance of about two inches, the wound being about one inch from the median line. On examination I found a comminution of the frontal bone, and removed several fragments, one of which included the supraorbital ridge and extended outward into the left temporal fossa, so that about one-half inch of the bone was removed from the anterior angle of that fossa. Fragments of bone were removed upward for a distance of nearly two inches, and other pieces extended over nearly to the median line. In removing a portion which was in the neighborhood of the median line the longitudinal sinus was opened and bled profusely. A pair of hæmostatic forceps was at once clamped upon the sinus, the forceps clamping the sinus against the skull, and was left in place after the application of the dressing and for the two days following. By means of these the hemorrhage was perfectly controlled. On following the fracture downward there was found to be a fracture of the supraorbital bone backward the entire depth of the anterior fossa, so that the finger could follow the fissure backward behind the sella turcica. The frontal lobes were extensively lacerated, and considerable portions of brain tissue were removed. In spite of the severity of the injury the patient was able to answer questions upon entering the hospital, and also shortly after recovering from the anæsthetic. In addition to the fractures described there was a transverse fracture extending from them to the right. It was located at about half an inch above the right supraorbital ridge and extended from the left side over and into the right temporal fossa. The superior fragment was driven inward, and the inferior fragment rested upon its anterior surface. By means of a strong hook the depressed portion of bone was brought backward into place, where it remained. The wound was thoroughly cleansed and packed with iodoform gauze. The wound pursued an antiseptic course, and there was little fever or general disturbance. A hernia cerebri gradually developed, having a diameter of about two inches and projecting above the surface of the skull a little more than half an inch.

This was carefully protected by iodoform gauze, and later was treated with powdered burned alum. On May 21st the hernia had become even with the surrounding surface and the greater part had been covered by cicatrization. The sense of smell seems to be entirely lost. The hearing was not affected. There is double vision of objects to the right of the median line, but the images blend toward the left. During the first three weeks there was mild delirium, although the patient always answered questions intelligently. He would at times, however, attempt to remove the dressings and get out of bed. The mental condition since that time has seemed perfectly clear, and the patient feels well. His condition is most promising.

The injury both to the skull and brain in this case were very extensive, and the loss of brain substance was considerable. The most striking feature was the widely gaping fracture extending through the supraorbital plate, so that the finger could follow it back to the optic commissure. It seems remarkable, also, that the patient should have retained his consciousness, being able to answer questions intelligently both before and immediately after the operation. The method of controlling hemorrhage from the longitudinal sinus is also interesting. About thirteen years ago I controlled a hemorrhage from the longitudinal sinus. caused by a sharp cut three-fourths of an inch in length, by a continuous silk suture. The case recovered without complication of any sort.

CASE IX.—J. G., male, aged thirty-one years. On February 23d, during a quarrel, the patient was struck upon the head, receiving a compound comminuted fracture of the skull over the left frontal eminence, about one-half inch outside of the median line. Upon examination, under ether, he was found to have a fracture, measuring about one inch vertically and one-half inch transversely, of both the external and internal walls of the left frontal sinus, the fracture running down to the point where the posterior wall joins the floor of the anterior cerebral fossa. There was no sensory disturbance; the pupils were equal and reacted normally. In removing the fragments of bone on the internal table the dura mater was found to be slightly punctured at one point, a small amount of cerebral fluid escaping, but aside from this there was no injury so far as perceived. There were no

other disturbances. The patient's condition seemed excellent in every way, there being no unfavorable symptoms of any sort. The temperature, however, gradually rose from day to day, until at the end of four weeks it reached 105°. It was difficult to explain the cause of the fever, since the wound seemed to be doing perfectly in every way; there was no cerebral disturbance, and the patient looked and said he felt well, and had a good appetite. On examining the abdomen a few rose-spots were found, the spleen was palpable and evidently enlarged. An examination of the blood by the Widal test gave the reaction which is supposed to indicate the presence of typhoid fever. The diazo reaction was also present in the urine. During the height of the fever there were slight nervousness and twitching about the face. After reaching 105° the temperature gradually declined during the next ten days to normal, the patient during this time receiving sponge baths. After remaining nearly normal for a week it was again irregular, and again reached 105°, but descended to normal about April 18th, and has remained so up to the present date. When the temperature was at its height the eyes were examined by Dr. Millikin, who found a slight amount of neuroretinitis of both eyes, suggesting the possibility of basal meningitis. A second examination of the eyes, made by Dr. Millikin on June 17th, showed vision of both eyes normal, with apparently a low grade of retinitis on the nasal side of disk in the right eye. The vessels, however, were of good size and normal in distribution.

This case was one of unusual interest. Though the skull was fractured and a small portion of both tables was removed there seemed to be no resulting disturbance which could in any way be referred to the brain, and the sensorium was perfectly clear at all times. The gradually increasing temperature, reaching 105°, falling to normal, and again gradually returning to 105°, and later falling to normal, is a striking feature of the case. The rose-spots, the enlarged spleen, and the diazo and Widal reactions strongly suggest the presence of typhoid fever. The clear sensorium, uncoated and moist tongue, good appetite, and general condition of the patient were not such, however, as are common in typhoid fever, and a careful observation of the case leaves me in extreme doubt if the conditions present were not the result of the cerebral injury, rather than that they were

caused by the chance association of typhoid fever with the injury to the head. The evidences of retinitis in both eyes suggest a basal meningitis, and must also be considered as a possible explanation of the peculiar temperature.

CASE X.—J. G., male, aged fifty-seven years; occupation, farmer. On May 9, 1896, the patient received a kick on the right side of the head nearly over the coronal suture. The scalp was cut through and the patient was rendered unconscious for a short time, possibly a half hour or an hour at the longest. He recovered, and without assistance walked to his house. The wound was dressed in the usual manner, and healed nicely. For two days the patient complained of faintness. About June 17th he began to complain of headache, not very severe, but persistent. He had always been free from any trouble of this kind, and was an unusually healthy man. From this date the headache continued until the time of operation. It was never very severe and the patient was unable to localize it. On June 20th the patient seemed to become dazed and lapsed into an indifferent state, being very quiet and listless, a condition utterly foreign to him. He complained of increasing lack of strength in his right arm and leg, which eventually amounted to partial paralysis. His ability to think and reason became less each day. The bowels were obstinately constipated; he had no appetite, and when undisturbed he manifested a tendency to sleep. I saw the patient on June 26th. On examination I found that his eyes responded normally to light, that motion was perfect, and that vision was seemingly intact. There was no difference in the pupils. The right arm lay apparently helpless, but when I insisted very strongly he would with great effort and deliberation raise it from the bed. The patient would grasp the hand with considerable firmness. He could move the right leg more freely than the right arm, but still only slowly and with considerable embarrassment. Sensation seemed normal in both right arm and leg. The knee reflex was normal. The left arm and leg were moved promptly. Patient seemed somewhat slow in comprehending what was said to him, but answered accurately all questions. There was a scar about two and a half inches long extending from the frontal region upward and backward at about one and a half inches to the right of the saggital suture, and parallel to it; this marked the point at which the man had been kicked. A curved flap was made with its convexity forward, the flap

having a length of from two and a half to three inches. Upon lifting the flap no injury could be found to the skull at this point. The skull was penetrated by a trephine, but the dura mater was found to be normal. The brain bulged strongly into the trephine opening. No pulsation could be felt. An aspirating needle inserted in all directions found nothing. A probe carried in all directions under the skull and outside the dura mater disclosed no roughness. It was therefore decided to trephine on the opposite side, in the region of the arm centre. I trephined upon the right side first, because the external injury had been at this point. The difficulty in moving the right leg, and more especially the right arm, indicated an operation upon the left side of the cranium. The scar upon the right side, however, was so distinct and the injury had been so severe that it did not seem warrantable to disregard it. This operation was, therefore, performed contrary to the direct indications of the case as derived from localization symptoms.

Upon laying bare the skull by the same method as had previously been done upon the right side, a blue point could be seen, as of venous blood, shimmering through the external table. There was, however, no fracture. The pin of the trephine was inserted at this point, and there was profuse hemorrhage of venous blood. Upon division of the skull this bleeding largely ceased. The dura mater was seen to be somewhat thickened and more dense than normal. Upon division of the dura there was an escape of a large amount of liquefied blood of a dark color. After this many clots were evacuated. The whole amount evacuated must have been from four to six ounces. The brain was pushed away from the skull sufficiently to accommodate the accumulation of blood, and the removal of the latter left a considerable cavity in the parietal region. The cavity was thoroughly drained by turning the patient upon his side and wiping it out with a sponge. The pia mater seemed to be intact. The cavity was drained with a short piece of rubber-tubing, and a small amount of iodoform gauze was inserted. Both wounds were dressed with iodoform gauze and a bandage was applied. The patient's condition at the close of the operation was good. After the operation the patient slept almost continuously for thirty-six hours.

The wound discharged a large amount of serum, but healed, except at the points of drainage by first intention. For sometime after the operation the patient was unable to articulate distinctly and swallowed

with difficulty, but his mind was perfectly clear. The paralysis of the right side was entirely relieved, and the patient used his limbs freely. He still complained of some headache, but this gradually decreased. Following the operation the temperature the first day was 100°, and the second 99°, the third 98°, and the fourth 98°, and the fifth 98°. Previous to the operation the pulse-rate varied from 60 to 70. After the operation the pulse-rate increased to 120 the first day, but steadily declined to 80. I saw the patient about two years after the operation, at which time he was perfectly well.

The great interest in this case is that without a discernible fracture at any point of the right parietal region hemorrhage of the left parietal region should have followed a blow upon the right parietal region. It is possible that, although kicked by a horse upon the right side, the patient may have fallen upon and struck the left side of the skull. If so, there was nothing in the condition of the scalp on the left side to show such an injury. It would seem to be a well-marked case of transmission of force from the parietal region of one side to the other. The unusual feature is that the point of the blow and the point of hemorrhage should be so near to the median line of the vertex of the skull.

GUNSHOT WOUNDS IN CIVIL PRACTICE.

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THE recent war has given a fresh impetus to the study and the technique of treatment of gunshot wounds. Recent writings have pretty thoroughly exploited the nature and treatment of gunshot wounds received in modern battles. Rifles, such as are used nowadays by armies in the field, are of small calibre, have long conical steel or metal jacketed bullets, which are fired at tremendous velocities, and are used at long range; the wounds inflicted by these guns differ both in effect and prognosis from wounds produced by the ordinary cheap civilian pistols, which have short blunt leaden bullets of very low, comparatively, velocities, and which inflict the injuries usually at short range.

Another variety of gunshot injuries in civil practice are shot gun (ordinary "fowling piece") wounds; these are unique in many respects.

I purpose in this paper to study the nature and character of ordinary cheap pistol wounds and shotgun wounds produced at very short ranges—wounds produced, in most of the cases, by a discharge of the piece almost in contact with the wounded part. This study is based upon 56 cases which I have seen and treated in the last few years.

PISTOL-BULLET WOUNDS.

SHOCK. The first effect of these wounds, even if they are not very serious, is usually marked psychical shock; as a rule, the wounded person falls, if the wound be anywhere in the head

or trunk; he is found to be very weak, and to manifest the usual signs and symptoms of shock—namely, pallor, weak slow pulse, dilated pupils, slow sighing respirations, and cold moist surface.

Hemorrhage. Hemorrhage is rarely profuse, unless a cavity be injured; as a rule, little blood is seen externally.

Character of the Wound. The wound of entrance is usually small, round, punched out in appearance, and is surrounded by a markedly discolored, frequently dark brown or black ring of skin, which, I presume, is produced by the carbonized heated bullet; frequently, in bare parts, the wound is surrounded by an area of powder marks—that is, grains of black powder driven into the skin. The subcutaneous connective tissue shows a much larger wound than the skin, and the muscles show a wound larger than the skin wound and smaller than the connective tissue wound. The course of the bullet is rarely true—I mean by that, that a pistol bullet below a 38 calibre is very easily deflected and rarely pursues a straight course through the tissues, even when fired point-blank. Unless the skull or facial bones be implicated, the bullet is usually arrested or split and deflected by striking a bone. The long bones are rarely shattered by small calibre bullets from cheap ordinary revolvers. The penetrating power of these bullets is usually slight. Out of 8 cases of wounds in the thorax, in 4 only did the bullet enter the cavity of the thorax; the abdominal cavity is usually penetrated, however, when the aim is point-blank.

The large vessels have so generally escaped in cases of pistol-shot wounds I have seen, even when apparently in line, that I am persuaded the sheath and the elasticity of the vessels themselves serve to deflect the missiles.

Effect upon the Viscera or the Contents of Cavities.

Wounds of the Cranium. I have had but one case, in this series, of penetrating wounds of the cranial cavity. This was a wound through the parietal bone of the right side, about 4 cm. above and in a vertical line with the mastoid process.

This wound presented the frequently described and well-known peculiarities of ordinary gunshot wounds of the cranium, namely, small entrance wound, almost round, splintered internal table, with spicules of bone driven into the cortex, large irregular laceration of the dura and wide area of destruction of cerebral tissue, considerable hemorrhage, and escape of cerebral matter.

WOUNDS OF THE THORACIC CAVITY. Unless the wound is in the middle mediastinum the effect is not necessarily very serious. Of 8 gunshot wounds of the thorax, I have seen but 2 cases of serious hemorrhage into the cavity of the chest. As Dr. Matas has shown in a recent study entitled "Surgical Treatment of Perforating and Bleeding Wounds of the Chest" (*Journal of the American Medical Association*, April 1, 1899, p. 687), that wounds of the internal mammary arteries and the intercostal vessels may cause fatal bleeding. Wounds of or near the root of the lung are usually fatal. It was formerly considered that a pistol-bullet wound of the heart was necessarily fatal. Beside a few other cases on record, I think the history of the following case will prove that this is not always true:

A. S., a Pennsylvanian, aged twenty-nine years; a spare, wiry man; about two hours before his admission into St. Luke's Hospital he shot himself, with suicidal intent, in the left chest, using a 32-calibre cheap revolver. Immediately after the shooting the man is said to have fallen over, and was unconscious for a short time.

When admitted, shortly after the infliction of the wound, the man was very pale, respiration 40 per minute and slightly jerky in character, pupils somewhat dilated, pulse 108, weak, but regular; there had been but very little external hemorrhage. Examination showed a small blackened bullet-wound 2½ cm. above, 6 mm. within the left nipple and 6 cm. to the left of the sternal border, over the lower border of the fourth costal cartilage. There was great tenderness about the wounded area and over the epigastrium. Heart-sounds very weak, but regular and distinct; the respiratory sounds on the left side were weak, expansion lessened, few moist râles in the axillary region; percussion note

showed increased resonance. Slight cough and bloody sputum. About ten minutes after he arrived in the hospital, emphysema and some swelling were noted about the wound. Examination

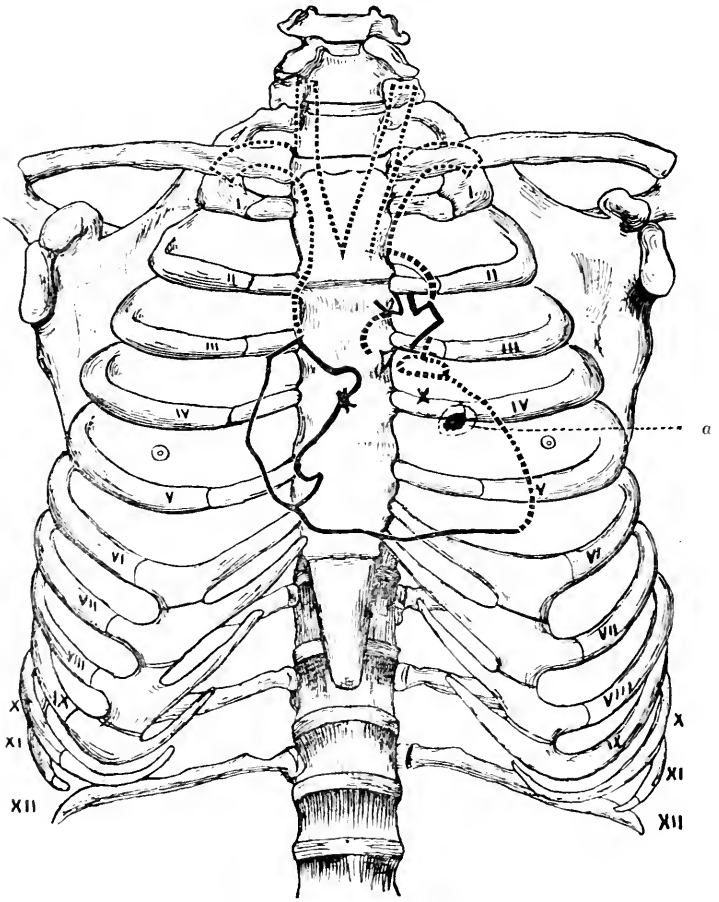


Diagram showing the entrance wound of the bullet, with reference to the bones and location of the heart. *a*. Wound.

of the back showed a small, oval, hard mass 2.5 cm. below and 1.5 cm. inside of the angle of the scapula, on a line with the interspace between the eighth and ninth dorsal spinous processes, and 3.5 cm. to the left of the spinal column. This was

the bullet. Under careful aseptic precautions, probing, enough to demonstrate the fact that the bullet had actually entered the thoracic cavity, was done. Then, after careful cleansing and disinfection, the wound was plugged with iodoform gauze, dressed, chest strapped and bandaged, and the patient put to bed. Sufficient morphine was given to obtain the strictest quiet; he was carefully watched, to see that he himself made absolutely no exertion.

A consideration of this case, after the careful examination I gave it, greatly puzzled me. It was very clear that the bullet had entered the chest directly over the position of the right ventricle; that it was not deflected and went around the chest walls was clear, as the lungs were undoubtedly punctured; the patient continued to expectorate blood until the 18th, and the physical signs indicated an indurated area of the lung later on. The heart-beat and its area were mapped out carefully, and all the physical signs indicated that the heart was directly in the track of the bullet, and there certainly was no transposition of the organ to the right side. On the other hand, there was no appreciable hemorrhage into the pericardium, and very little hemorrhage into the pleural cavity. The heart action was weak and rather rapid, but the sounds were clear and without bruit, and the man's general condition was not exceedingly bad when he entered the hospital, and improved steadily for twelve days, and no untoward symptoms developed. There were, on the 19th, signs of circumscribed consolidation of the lung in the anterior axillary region, and he had developed a slight and not very frequent cough. On the 28th the man's general condition was very good in every way, his respiration was nearly at a normal rate, heart-sounds were clear, the heart-beats were felt in the normal position; temperature normal, and, in short, he was considered convalescent and past danger. I concluded, by some curious accident, the heart had escaped injury.

He wished to have the bullet, which still remained just under the skin in the dorsal region, removed. On this day he was brought to the operation-room on a rolling stretcher, where I think I had been doing some other operations; he was lifted to

the table, and, under Schleich's local anæsthesia, I removed the bullet. He did not seem particularly excited, he had made no exertion, he had no pain from the little incision, and yet, very soon after he was returned to the ward, he became restless and anxious, and complained of severe pain in the epigastrium. His restlessness and anxiety increased, and morphine had to be given him to relieve his pain; gradually his pulse-rate ran up, he became cyanosed, breathed with difficulty, and felt and looked as if he would die. I saw him about 11 P.M. of this day again. I found his pulse almost imperceptible at the wrist, I could feel no heart-beat at all; he was in a clammy sweat; he required to be propped up in bed, and had intense epigastric pain; he seemed almost moribund. Strychnine and morphine were given in generous doses, and after he quieted down the left chest was found perfectly flat on percussion; there were no breath-sounds anteriorly at all, and no heart-beats could be felt. The next day, and for several days, he had slight fever (100° to 101° F.), his pulse remained weak and respiration rapid for a number of days, and the epigastric pain was almost constant for about forty-eight hours.

The second day after the attack the heart could be faintly heard to the right of the sternum and high up near the third rib. No impulse could be felt. As soon as practicable after the outbreak the chest was explored posteriorly as well as anteriorly. It was found that respiratory sounds could be heard posteriorly, but bronchial in character; there was decided dulness, but nothing like the quality of the sound on the anterior surface of the chest.

After the third day the man began to improve steadily. The chest dulness and the weak heart-sounds continued for about three weeks, however. July 19th it was noted "Percussion gives normal note above the third rib; somewhat improved below; patient feels better." He improved slowly, and was discharged August 4th, seven weeks and one day after entering the hospital. At this time the following physical signs were noted: There is dulness over the whole left chest anteriorly from the subclavicular region downward; axillary region dull, poste-

rior dulness from spine of scapula downward. Auscultation: Broncho-vesical breathing over the whole chest, except the regions above the third rib, where the breathing is vesicular. Palpation shows very weak heart impulse; this is felt most distinctly in the *epigastric region*. No pulsation can be felt in the normal cardiac region. The heart-sounds are heard most distinctly 2.5 cm. to the right of the ensiform cartilage in the epigastric region, thence they can be heard upward along the right border of the sternum as far as the fourth costal cartilage. The area of cardiac dulness extends obliquely from left to right from above downward. It begins on a vertical line 1.5 cm. to the left of the left nipple and extends to the right 6 cm. beyond the sternum; above it merges into the dulness of the lung and cannot be accurately mapped out, but it extends downward 6 cm. below and 6 cm. to the right of the ensiform cartilage. The dull cardiac area measures about 22.5 cm. by about 15 cm. The man was still weak and pale (pressure over the epigastrium still caused pain). There had undoubtedly been a severe hemorrhage the night after the removal of the bullet—*i. e.*, twelve days after the wound. There was no bloody expectoration nor any other evidence of purely pulmonary hemorrhage. One must conclude, it seems to me, that the hemorrhage was most probably from the heart itself into the pericardium at first, and then into the pleural cavity through the rupture of the original laceration of the pericardium. A skiagraph taken after the hemorrhage showed what seemed to be the heart surrounded by clotted blood, and the pleural cavity nearly full of the same.

As a rule, however, pistol-bullet wounds of the heart cause considerable laceration of the organ, and death follows. I have seen but two cases of pistol-bullet wounds of the middle mediastinum, and both died. One case was seen in consultation fourteen days after the wound was made, the bullet was 38-calibre, had entered obliquely from the right near the upper border of the third rib near its cartilaginous junction, and had ranged inward and a little upward. The right pleural cavity was full of blood; the right lung had been compressed so that an area of about 8 cm. in diameter only, in the upper inner corner of

the thorax, was resonant. When seen the man was very weak, the left lung was already œdematous, respiration was rapid, short, and difficult. I aspirated the right chest and withdrew about 800 cm. of fluid blood. This relieved the man somewhat. It was proposed to incise, wash out, and drain the right chest if the man should become strong enough, but he died shortly after I saw him.

The other case was almost dead from hemorrhage when seen soon after the wound. He died without any operative attempt to empty his chest. It would seem, therefore, that the wounding of large vessels in cavities, by low velocities and small leaden bullets, is just as bad or worse than by steel-coated high velocity bullets.

Two cases of through-and-through puncture of the lungs not near the roots of the organ healed rapidly, there was only a little bloody expectoration for a few days, no appreciable intrapleural hemorrhage, and very little cough.

Penetrating Pistol-bullet Wounds of the Abdomen.

As Bull, Senn, Oliver, Nancrede and others have made careful studies of these wounds, and my observations have not added anything material, except in one particular, I will only discuss this one point—namely, the great laceration and almost certain fatality of low velocities on solid viscera and large mesenteric bloodvessels.

A very interesting case of a 32-calibre wound which had entrance in the upper left hypochondriac region, and which passed through the diaphragm, both posterior and anterior walls of the stomach, through the mesocolon, and finally lodged in the head of the pancreas, gave an opportunity to study these effects. A laparotomy for exploration several hours after the injury showed (though the puncture in the anterior wall of the stomach was much larger than the bullet itself, and decidedly larger than the wound of entrance on the posterior wall) that there had been no escape of the contents of the stomach; the wound in the mesocolon was a large one, at least three times as large as the bullet itself, and the pancreas was lacerated to even

a greater extent. The abdomen was full of fluid and clotted blood. The man died of hemorrhage, which could not be controlled by packing and rapid suturing.

Pistol-bullet Wounds of the Extremities.

Except in one case I have not found these wounds serious, and this was the only case in which a large vessel of the extremities was injured by a bullet. It was a case of injury to (laceration of) the popliteal space and posterior tibial vessels. This required ligation of the vessels at the point of injury in the popliteal space. The limb was saved, but œdema persisted.

The bullets rarely escape from the tissues, except when the hand or foot are the parts involved. A very recent case of attempted suicide exhibited the weak force of the ordinary small pistol very strikingly. A muscular young man used his left hand and discharged a pistol, with the muzzle almost in contact with his clothing, into his right pectoral region. The ball entered the walls of the chest over the outer part of the pectoralis major muscle and ranged obliquely outward and upward. It passed through a part of the deltoid muscle, struck the head of the humerus, internal to the bicipital groove, tore off the fascia and periosteum, and, without seriously injuring the bone, was deflected upward and lodged near the acromion process of the scapula.

Examination of the bullets *in situ* before their removal show that they rarely preserve their point forward direction; they are nearly all more or less lateralized, and I think to this fact is largely due the severe lacerations of the deeper tissues produced by them. Even when the bullets have not struck any bone they are nevertheless considerably distorted.

Very frequently with the bullet, at its point of arrest, are found shreds of clothing which it has taken with it through the tissues; as a rule, these shreds are carried the whole course of the missile through the tissues, and are found about the bullet or just behind it. I cannot recall a single case where the shreds were found in front of the bullet.

Treatment of Pistol-bullet Wounds. Hemorrhage from

the external wound may usually be controlled by plugging with iodoform gauze and firm strapping or bandaging. Wounds of deep vessels demand incision and ligation. Dr. Matas has recently shown the importance of this when the internal mammary and intercostal vessels are lacerated.

I have learned to regard the probe as the most dangerous factor in gunshot wounds after the immediate survival of the patient is assured. As a routine practice, probing gunshot wounds cannot be too strongly condemned. I cannot recall a single case of suppuration after pistol-bullet wound when the probe was not used. Furthermore, I have convinced myself and have frequently demonstrated that it is almost impossible to accurately follow the course of a small bullet through the soft tissues with a probe. As a means of locating a bullet the probe is utterly misleading, as it will readily follow along the planes of connective tissue and muscles in directions quite different from the true course of the bullet. Whenever practicable the X-ray determination is the only proper method of locating a bullet. This method is sometimes difficult, and may prove misleading also, as a case I had sometime ago proves. About two months after receiving the wound a lad was brought to me with an abscess involving the whole anterior surface of the thigh, with a history that he had accidentally shot himself with a pistol in the upper anterior part of the thigh. He had been probed, cut, and poulticed after the most approved 1862 style of treatment, but the bullet could not be located, and the large abscess and the persistent suppuration had undermined his strength and constitution. He was in a low septicemic condition when I saw him first. Careful fluoroscopic examination seemed to clearly locate the bullet at a certain point inside the deep muscles of the anterior thigh. This region was incised and explored, with the result that a balled-up shred of his trousers, covered by blood and pus, was found at the locality marked, but the bullet was found several inches further down.

Unless the bullet has entered the abdominal cavity and *below the line of the umbilicus*, I believe, unless *the condition of the patient* clearly indicates that some effort should be made to

remove it, that no attempt to remove the bullet soon after the injury should be made. Later on, if it be superficial, or if it can be demonstrated that it is doing harm, then it may be removed if it can be clearly located by X-rays.

One superficial feature of pistol-bullet wounds at short range I have found almost constantly, and that is a destruction. I think it is by burning of a rim of the skin immediately about the entrance wound. This will surely necrose. I think this rim should, as a rule, be excised, and, if the course of the bullet is very oblique and superficial, a linear incision should be made through the skin for a short distance, in order to assure proper drainage. Let alone, the undermined skin will almost surely act as an occlusion valve, and prevent proper drainage of serum and blood. The wound, and the skin for some distance about it, should be most carefully cleaned and disinfected, then the wound should be plugged with 10 per cent. iodoform gauze and an aseptic dressing applied. After this perfect rest, if possible, of the wounded part should be obtained. Subsequent treatment must be carried out on general principles.

Wounds Produced by a Charge of Small Shot at Short Range.

The wounds produced by small shot differ most widely according to the range. At present I purpose to discuss the effect of these missiles only at very short range. The wounds thus produced are very formidable injuries, and have some peculiarities which do not belong to any other gunshot wounds. I have had the fortune, in a comparatively short time, to treat small shot wounds of the face, axilla, shoulder, lumbar region, abdomen, thigh, and foot These wounds have all presented the same general characters: 1. A comparatively small, round wound of entrance. 2. Extensive laceration of the muscles and deep tissues. 3. Violent hemorrhage. 4. Pollution of the wound by shreds of clothing and by the wads which are used in loading.

1. Wound of Entrance. This is round and is clean cut, as if it were produced by a solid ball—indeed, it may be said to have been produced by a solid missile as it is made by the wad

or wads which are used to hold down the shot in the modern loading of shotguns. There are usually very few powder marks, but if the muzzle of the gun was very close when discharged, the skin surrounding the wounds of entrance will be excoriated (burned) superficially. This rarely causes death of the whole skin, however, only severe blistering.

2. Extensive Laceration of the Deep Tissues. Within a few inches from the muzzle of the gun a charge of small shot begins to spread out in a sort of conoidal form, the wad usually apparently occupying the centre of the base of the cone. The effect is an explosive one; the tissues are not only mechanically torn by the numerous individual diverging pellets, but are burst asunder by a rending force similar to a gaseous explosion. The combined effect is tremendous. In two cases, one of the thigh, when the wad and most of the pellets escaped through a wound of exit, and the other of the lumbar region, where the whole charge was arrested at the brim of the pelvis, this effect was most marked. The wound of entrance would barely admit one's thumb, but three inches away a cavity was torn big enough to almost receive one's fist. The penetrating force of a charge of small shot is much greater than that of an ordinary pistol, and the charge is not easily deflected. Thus, in a wound of the shoulder, when the charge entered in the outer pectoral region, it went straight to and into the head of the humerus, crushing it utterly. The wad was lodged deep in the cancellous tissue of the bone, quite as far as the shot themselves.

3. Hemorrhage. The sheaths of the vessels do not deflect the pellets, they go straight through the vessels, and act very much like little punches in cutting out bits of the coats, thus lacerating the vessels in such a way that the hemorrhage is very free and not apt to stop spontaneously. The large number of the pellets make shreds of the vessels directly in their course; this, together with the large destruction of the surrounding tissue, make conditions for uninterrupted bleeding, and furnishes one of the greatest primary dangers of these wounds.

4. Pollution of the Wound by Shreds of Clothing and by the Wad. This is a constant result. In every case I have

found shreds of clothing deep down in the tissues; they are deposited behind the wad and most of the charge of shot, as a rule.

The depth of penetration and effect of the wad has always been a source of wonder to me. As I said a little while ago, in a case in which the head of the humerus was shattered I found the wad almost intact, deep within the cancellous tissue of the bone; in every case in which the charge did not escape the wad was found well up in the front rank of the farthest advanced pellets, and occupying a space about the middle of the spreading charge. Passage through the soft tissues scarcely bends the wad even, and bones affect its symmetry very little. Beside the lacerating effect of the wad, another and very important result of its entrance into the tissues is *infection*. Wounds of the kind under discussion are always infected wounds, and will almost surely suppurate. This fact makes them *sui generis*, and makes their treatment differ from that of other gunshot wounds. As one of the primary indications, there must be early (immediate if possible) removal of the wad and incidentally the charge of shot. After this, careful and thorough drainage must be obtained.

Small shot wounds at very short range are exceedingly dangerous injuries. Hemorrhage is the primary danger. Of 10 cases I have seen and treated 2 died, both after very severe hemorrhage. While it is true that these injuries must almost of a necessity be fatal when one of the principal cavities of the trunk or the cranium is the part affected, the following case will show that some cases may be snatched from the jaws of death if seen in time and prompt measures be taken to stop hemorrhage, and lacerated viscera be removed

Case of Small Shot Wound of the Abdominal Cavity; Laceration of the Spleen, Mesocolon, and Kidney, and Probably Laceration of the Stomach also; Recovery.—A. B., aged forty-five years; born in Pennsylvania, miller by trade, was admitted into St. Luke's Hospital April 6, 1897.

A short time before admission the man had attempted to commit suicide by firing a charge of small shot into his abdominal cavity. Just how he managed it it is difficult to understand, but the charge entered the left hypochondriac region over the

eighth costal cartilage, 8 cm. from the median line; it shattered the ninth as well as the eighth cartilage and entered the abdominal cavity. Examination showed the wound of entrance to be a bevelled, oval opening about 1.5 cm. in diameter; it was surrounded by a reddened zone of blistered skin. Posteriorly, just above the crest of the ilium and immediately anterior to the quadratus lumborum muscle, was a large crepitating swelling, with a puncture of the skin at one place about 3 mm. in diameter; through this small puncture blood was flowing freely.

When the ambulance reached the man he was found in a puddle of blood, and his clothing was saturated with blood. He had to come about a mile to reach the hospital. When he arrived he was almost moribund. He was very pale, respiration 40 per minute, and radial pulse scarcely perceptible. He was evidently bleeding to death. So, rapidly cleaning the abdomen, lower chest, and lumbar region, he was chloroformed and an incision made into the abdomen below, parallel with, and about a finger's breadth beneath the border of the ribs. The abdomen was full of fluid and clotted blood, which seemed to be pouring out in a steady stream from the left lumbar region. A rapid examination showed the charge had gone downward, backward, and outward. It had deeply furrowed the spleen in a number of lines, had made a large rent in the mesocolon, had missed the intestine itself, and gone through the left kidney and torn it into shreds from the middle downward. Large quantities of gauze were stuffed into the lumbar region, and while an assistant pressed it well down I made a free opening in the lumbar region from the crest of the ilium upward over the swelling, which I knew marked the location of the charge. I turned out the wad, shreds of clothing, and a charge of No. 5 shot, and rapidly introduced my hand down to the kidney, grasped the pedicle, raised the lacerated organ upward, and ligated the pedicle *en masse* through the abdominal opening. The double opening gave great facility in the manipulations required for ligating and detaching the kidney. The spleen and mesocolon were also bleeding freely; the man's condition permitted only packing iodoform gauze strips about the spleen and

into the laceration of the mesocolon; the ends of these strips were brought out of the lumbar wound. A rapid examination of the stomach failed to discover any puncture of this viscus, and, as it was empty at the time, I thought it had escaped. Persistent vomiting of dark brown grumous matter for several days after the operation seems to show that it was probably injured. The abdominal cavity was thoroughly flushed with a hot saline solution. The abdominal incision was closed, the lumbar incision was left with a large opening through which the iodoform gauze packing projected. The wound of entrance was also plugged with iodoform gauze, and the usual dressing applied. The man rallied slowly under large doses of strychnine, rectal saline infusions, etc.

For three days the patient vomited quantities of dark matter, which was evidently blood and mucus. He was fed by the rectum and nothing allowed by the stomach. By the 10th (in four days) the vomiting ceased and did not recur. The lumbar wound suppurated actively; but, notwithstanding this the patient made almost an afebrile recovery, and without any complication. He was discharged on May 31st after fifty-six days in the hospital. There was a narrow sinus still remaining in the lumbar region, which led down to the stump of the pedicle of the kidney. This healed very soon, and the patient seemed as strong and well as before the injury.

THE TREATMENT OF WOUNDS PRODUCED BY A SHOTGUN AT CLOSE RANGE CONSISTS IN THREE SPECIAL INDICATIONS: 1. STOP HEMORRHAGE. 2. REMOVE THE SHOT, THE WAD, AND SHREDS OF CLOTHING FROM THE TISSUES. 3. PROVIDE FOR CAREFUL AND ADEQUATE DRAINAGE.

1. Hemorrhage is always severe, as I said, and even in regions not excessively vascular it is necessary to attend very promptly to hæmostasis. A little while ago a strong plethoric girl was shot through the anterior part of the middle third of the thigh. No large vessel was injured, and yet when she reached the hospital a few hours later she was almost moribund from acute anæmia. It required most active and persistent use of saline

infusions and strychnine to resuscitate her. Packing with gauze and a firm bandage controlled the hemorrhage completely. The wound was tremendous where the charge made its exit on the anterior surface, a little above the femoral vessels.

2. As I said, the wad and shreds of clothing will always be found with the shot in the tissues where the charge has lodged. Curiously enough, I have never found but one wad, or at least only those used in retaining the shot in the cartridge or gun barrel (sometimes two are used), the ones over the powder are probably consumed or broken into pieces by the explosion. These wads are always sources of infection, as are the shreds of clothing also. Deep suppuration will result from their presence in the tissues, and will be disastrous unless they are removed.

3. As the wounds are always infected, proper drainage must be provided for ridding the tissues of the products of local sepsis. By this means and the careful and frequent use of antiseptics, general infection may be avoided.

LIST OF GUNSHOT WOUNDS TREATED.

1. *Pistol Wounds.*

	Cured.	*Died.*
Wound of abdomen, penetrating, and wounds of viscera		2
" abdomen and hand, no wound of viscera	1	
" arm	2	
" arm and thorax	1	
" cranium, penetrating		1
" face	1	
" foot	5	
" forearm	1	
" gluteal region	1	
" gluteal region, of rectum, urethra, and inguinal region	1	
" hand	4	
" inguinal region	1	
" leg	4	
" leg and thigh	1	
" neck (posterior part)	1	
" popliteal space and posterior tibial vessels	1	
" shoulder	3	
" thigh	5	1
" thigh and forearm	1	
" thorax, non-penetrating	3	
" thorax, non-penetrating, and thigh	1	
" thorax, penetrating	2	2
Total	40	6

2. *Shotgun Wounds.*

	Cured.	*Died.*
Wound of abdomen, penetrating, and wounds of viscera	1	
" axilla, penetrating		1
" elbow	1	
" face		1
" foot	1	
" lumbar region	2	
" shoulder	2	
" thigh	1	
Total	8	2

THE REMOVAL OF AN ŒSOPHAGEAL DIVERTICULUM.

By W. JOSEPH HEARN, M.D.,
PHILADELPHIA.

This operation was performed July 1, 1896, the subject of which was a sea captain, aged fifty-two, who had suffered from difficulty in deglutition for about fourteen years, and which increased rapidly during the year preceding operation, causing a loss of strength and of forty pounds in weight.

His ancestors were longlived. His father and mother died aged ninety-eight and ninety-six respectively, and paternal grandfather at one hundred and seven.

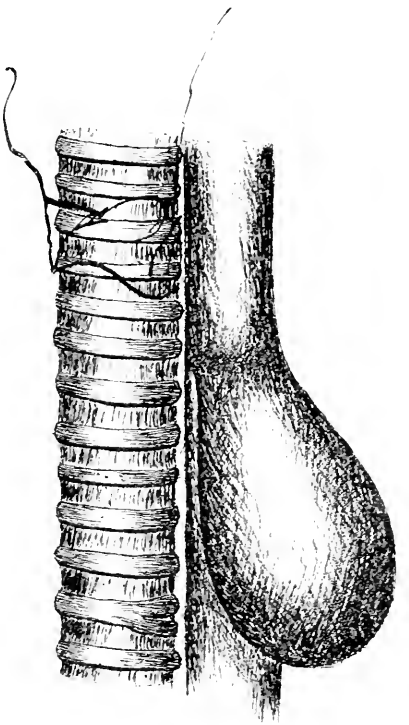
He gave the following personal history: Yellow fever in 1865; variola in 1872. Had a severe attack of diphtheria, which began March 25, 1882, during which he had several violent paroxysms of coughing. He never had syphilis.

Soon after this attack he began to notice some disturbance of deglutition, which gradually increased until in 1885 he received treatment in Savannah, Georgia.

The difficulty continued, and in 1887 he was under treatment in Brooklyn, N. Y.

In 1889 he consulted the writer and presented the following interesting manifestations. Coincident with swallowing, a noticeable bulging or fulness appeared at the lower left side of neck beneath the sternocleidomastoid muscle. Upon taking food the sac became distended, after which only liquid or any soft food would enter the stomach, and that with great difficulty. Regurgitation of undigested food was of frequent occurrence, and could be occasioned by bending forward or making pressure over the sac, and sometimes occurred many hours after taking food, and was accompanied with a peculiar noise.

It was impossible to introduce a bulbous bougie into the stomach, being stopped about seven inches from incisor teeth. On introducing a bougie, with a Mercier curve, it was found that when turned toward the left side it came to a stop at above distance, but if turned toward the right side it could be introduced into the stomach with difficulty.



For two months systematic treatment by introducing graduated bougies was practised, but with very little benefit. Having made the diagnosis of diverticulum of œsophagus, I advised operation for its removal, but he refused. Had he consented I would have preceded von Bergmann by several months.

He was seen in consultation by Prof. W. W. Keen, who confirmed my diagnosis and also advised operation; but patient would not consent.

He was under observation until September, 1890. In March, 1893, he again came under my care, and during the year previous to opera-

tion there was a marked increase in the size of sac, and especially in the last six months, causing at times complete obstruction and considerable dyspnœa.

At first he slept principally on left side, otherwise there occurred dribbling of fluids from mouth. Sleeping in the recumbent posture gradually became intolerable, and within the past four years he much preferred to rest and sleep in a high-backed chair.

Operation, July 1, 1896. In preparing for operation he was repeatedly given warm sterile water to swallow until the sac was full, which was then expressed or regurgitated until the pouch was thoroughly cleansed as indicated by clear fluid returned.

Next a large acorn bougie was introduced and allowed to remain *in situ*. Ether was administered. An incision about four inches in length beginning above, opposite to the cricoid cartilage and extending down to sterno-clavicular articulation on left side. The sac was readily found, and demonstrated the advantage of having the bulbous bougie introduced, and readily dissected free from adjoining tissue by using the Allis dry dissector. There were no important vessels requiring ligation, and the recurrent laryngeal nerve was not seen. The upper surface of neck of sac was on a level with the third and fourth tracheal rings, and the sac extended for three inches downward and reached the apex of lung, the parietal pleura of which was exposed. The sac was excised with scalpel at its junction with œsophagus, and the mucous membrane was closed with catgut suture in vertical direction. Next, the muscular wall was brought together with silk, and a third row of silk was introduced in the connective tissue, to reinforce the muscular wall. The upper three-fourths of skin wound was closed with silkworm-gut and the remainder packed with iodoform gauze, to protect the parietal pleura. The packing was removed in forty-eight hours, and the wound was healed completely in twelve days, and the patient left the hospital on the thirteenth day. He was given liquid nourishment by the mouth twelve hours after operation, which he swallowed without any great difficulty. Convalescence was uninterrupted and he rapidly regained his former strength and weight, and resumed charge of his vessel in eight weeks following operation, and has been in the best of health since.

Whitehead believes that "pressure on acquired diverticulæ" is, according to authority, rare in women, for out of twenty-two reported cases collected by Zenker and von Ziemssen, in which

the sex was stated, not one occurred in a female. I have been able to collect four—Whitehead's own case, in which he did gastrostomy, von Bergmann's, Mixter's, and one reported by Edgreu and Quenset, a lady aged forty-one, which was complicated with carcinoma of œsophagus, but in which the diverticulum had existed previous to the malignant disease.

Butlin has observed six cases, upon two of which he operated, and a third in which he had the opportunity of examining the sac after its removal by a London surgeon, he having had the patient under his care some time previous to operation, and the other three presenting exactly the same symptoms. He states that all six patients were over forty-five years of age, and that the symptoms in all had begun after the fortieth year. Bychowski, however, reports a case of diverticulum of œsophagus of nine years' duration in a man aged twenty-one. In the table which I have prepared of cases operated on, and in which the age is given, they are from thirty-eight to seventy-three years, and from the onset of symptoms from thirty-four to sixty-nine years.

As regards duration, the course of the disease is invariably very slow. Wasting and loss of weight are rarely, if ever, observed until the late stages of the disease, and as Butlin suggests, whether it is possible to make a diagnosis if consulted within a few weeks or months of the first appearance of the symptoms.

Kocher gives his theory, "Traumatic, respectively mechanical, causes," a substantial support by means of the result of the microscopical examinations of the extirpated diverticulæ. The wall of the diverticulum is distinguished from the normal wall of the œsophagus through the absence of the muscular tissue (which consists of animal muscular tissue, according to Henle), that in such we have to deal with an inversion of the mucous membrane and its muscular layer, and also with a substantial thickening of the external layers of connective tissue in the shape of a relatively thick adventitia.

Zenker and von Ziemssen, in an article based upon a series of thirty-four cases, twenty-seven of which were verified by

necropsies, found that in pressure diverticula the most common situation was the posterior wall of the pharynx at its junction with the œsophagus, where the tube becomes suddenly narrower and more liable to injury. They further point out that the pouch in these cases is formed by a protrusion of the mucous membrane through the separated fibres of the inferior constrictor, and is, in fact, a simple hernia of the mucous membrane—"a pharyngocele"—and that these occasionally attain dimensions of 5½ inches long and 2 inches broad.

Lichtenstern, in support of the occasional occurrence of traction diverticulæ, reports an interesting case of the same, with rupture into the lung and death from pulmonary gangrene. Kelling reports an interesting case of deeply located diverticulum which he ascribes to an inflammatory process (tuberculosis in the mediastinum).

Von Bergmann thinks his case to be of congenital origin, as the pouch had a muscular covering on its outer surface, and as the patient had probably suffered from a cervical fistula in infancy.

In my own case I ascribed it to pressure, and possibly due to local nerve lesion and weakening of the mucular wall consequent upon the attack of diphtheria.

Kocher points out that the œsophagus is more easily distended below the beginning of the constrictor muscles, and that the distention takes place in the line of least resistance—that is to say, toward the left, where, as a rule, the diverticula are located. Konig found the pouch in one of his cases located on the right side. In the remainder of the cases in which the side was mentioned the pouch was found on the left side, usually lifting the sternocleidomastoid, but in one of Konig's cases it lifted the trachea forward.

Lilienthal gives us his method of differential diagnosis between œsophageal stricture and diverticulum. The plan adopted was to pass a tube through the stricture into the stomach and introduce a colored fluid and withdrawing the tube. Then allow the patient to swallow some clear water. On bending forward the fluid regurgitated was clear, showing that it

came from a diverticulum. This, however, is only admissible in cases in which it is possible to introduce a tube. Konig found it impossible in both of his cases, and in Bayer's case it became impossible at the end of two years.

Torch was able to say that the obstruction to the œsophagus in one case was pressure by an aortic aneurism, from the fact that its pulsations were transmitted to a tube introduced into the stricture.

As regards the operative treatment of excision of the pouch, the results have been universally successful, except in one case operated upon by a London surgeon and reported by Butlin, in which death occurred in two days from suppression of urine.

Von Bergmann excised the sac, stitched the mucous membrane of the œsophagus. The lower portion of the operation wound was closed with sutures, the remaining portion being plugged with iodoform gauze. The œsophageal wound closed by the sixth day. A small fistula which remained closed up after a few applications of the galvano-cautery. The wound in the neck then healed up by granulation without further trouble. The patient was given liquids immediately after operation.

Kocher's modification is as follows: He made a double ligation of the exposed inverted stump, separated it with the thermo-cautery, and after that cauterized the mucous membrane thoroughly. Finally, he sewed up the stump with the wall of œsophagus in an elongated direction, after having previously covered up the mucous stump with muscles and adventitia by means of a circular stitch. In the first case the wound healed *per secundum;* in the second case completely by primary intention.

Konig excised the sac and employed two rows of sutures, one through the mucous membrane, the other through the outer wall, while the neck of the sac was gradually divided from below upward. Nutrient enemata were given during the first four days.

Bayer extirpated the sac and introduced a sound into the stomach from the wound; pharynx and œsophagus were sewn up as far as the sound, and the external wound was tamponed with

iodoform gauze and left open. The recovery was uninterrupted. The sound was left in the wound for four days, after which it was passed by the mouth.

Mandach ligated the uncovered diverticulum with silk and excised it by means of the Paquelin cautery. Inversion of the neck of the diverticulum was not successful, on account of the large circumference of the stump, and drainage was introduced. The condition of the wound was complicated by parenchymatous secondary hemorrhage and phlegmon colli; complete healing after three months' treatment.

Mixter excised enough of the sac to make the œsophagus a straight tube from the "spur" up, and the edges were united with interrupted catgut sutures. External wound was closed, with the exception of a small opening for gauze drain. Recovery complete.

Kelling was successful in fitting his patient, "in whom a deeply situated diverticulum rendered operative healing impossible," with the best improved Mercier throat-sound, through which he had no trouble in taking his food.

From the twelve cases I have been able to collect I have prepared a table. Although characterized by its incompleteness, it gives some information in regard to the cases.

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Butlin, H. T. Brit. Med. Jour., 1898, pp. 8, 10; Trans. Royal Med. and Chir. Soc., vol. lxxvi, 1892.

Operator.	Sex and age.	Duration.	Treatment by sound.	Side.	Location of pouch.	From incisor teeth.	Pouch extended to	Operation.	Method, closure of œsophagus.	Size of pouch.	Size of neck of pouch.	Feeding.	Anæsthetic.	Wound completely healed.	Possible cause.
von Bergmann	F. 38	4 yrs.	.....	Left	Wall of œsophagus.	.....	.....	von Bergmann's.	Mucous membrane sutured.	.....	.....	By mouth	.....	.....	Congenital.
Kocher	...	.....	....	.....	Wall of œsophagus.	.....	.....	Kocher's modification.	Transfixed, ligated and cauterized.	.....	.....	.....	.....	.....	Preceding condition having led to vomiting Pressure.
Kocher	...	.....	.....	.....	Wall of œsophagus.	.....	.....	Kocher's modification.	Sutured the muc. memb. with wall of œsophagus & circ. suture	.....	.....	.....	.....	.....	
Butlin	M. 47	4 yrs.	.....	Left	Wall of œsophagus.	.....	.....	Butlin's modification.	Closed to sound.	.....	.....	4 days through sound in wound.	Ether		
Bayer	M. 70	4 yrs.	2 yrs.	.....	Wall of œsophagus.	....	.....	Butlin's modification.	Closed to sound.	.....	.....	4 days through sound in wound.			
Konig	50	.....	. ...	.....	Lower limit of pharynx.	.....	Clavicle and lifted sternocl'do mastoid.	von Bergmann's.	Two rows of sutures, mucous and muscular.	Man's fist.	Man's thumb.	Enemata 4 days.			
Konig	62	.....	....	Right	Lower limit of pharynx	....	Between tracheaand œsophagus, lifted trachea.	von Bergmann's.	Two rows of sutures, mucous and muscular.	.....	Man's thumb.	Enemata 4 days			
Mandach	.	7 yrs.	.. ....	Left	Wall of œsophagus.	.....	.....	Kocher's modification.	Ligated, cauterized, inversion failed.	Length $6\frac{1}{2}$ cm., circumf. 9–10 cm.	.....	.....	Ether.	3 mos.	
Mixter	F. 50	From birth; severe 4 yrs.	Previous to admis. to hosp	Left	Wall of œsophagus.	.....	....	.....	.....	.....					
Hearn	M. 52	11 yrs.	... .	Left	Wall of œsophagus.	7 in	Clavicle and pleura and lifted sternocl'do mastoid	von Bergmann's.	Three rows of sutures, mucous, muscular, adventitia.	Length 3 inches.	Man's thumb	By mouth	Ether.	12 days.	Pressure.
Butlin	M. 73	4 yrs.	...	... ..	Wall of œsophagus.	.....	.....	von Bergmann's	Closed with fine silk sutures.	.	. .....	By mouth	.. ...	20 days.	
London surgeon, reported by Butlin	M. 55	5 yrs.	.....	Left	Wall of œsophagus.	9 in.	.....	von Bergmann's.	.	... ...	.....	.....	.....	.....	Sudden pressure.

IMPERFORATE RECTUM.

BY OSCAR H. ALLIS, M.D.,
PHILADELPHIA.

I WAS called May 6, 1899, to see a male infant who was then five days old, and had had no evacuations from the bowels. From the second day it was known that the bowel was imperforate, through an examination by Dr. Walter Webb, the attending family physician. On examining the child, the appearance of a normal anus was satisfactory, but on exploration its depth was found to be only about an inch. A large ear speculum dilated the passage, and a head mirror gave a good illumination, but there was no sign of a dark background and no bulging was detected. An exploratory puncture gave no evidence of a bowel near at hand. The case was then abandoned, with instructions to bring the child to the hospital that afternoon or the next day. Instead of doing so, the child was kept until eleven days old and then brought for operation.

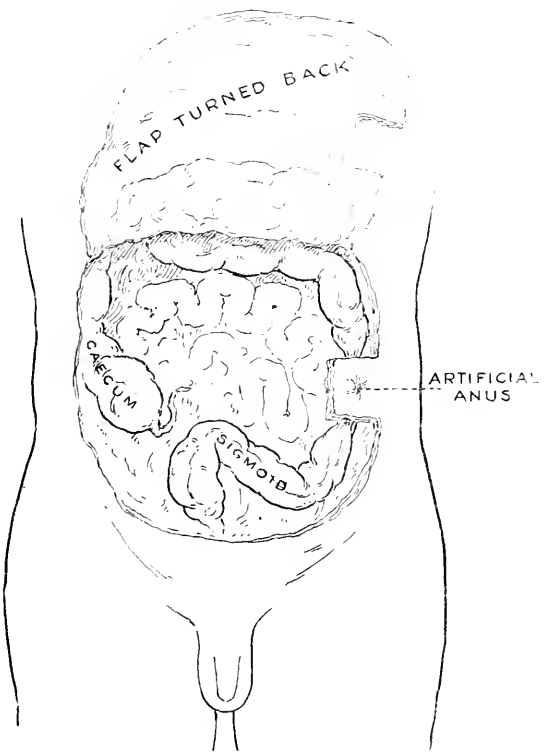
Condition at the Time. Child greatly emaciated; has not nursed since second or third day—bottle fed, but with no evidence of hunger —was only taking a few teaspoonfuls of milk at the time it was brought to the hospital.

Belly largely distended; belly walls quite dark from venous stasis. Outline of distended bowels distinctly seen and readily mapped out through the thin abdominal walls.

Operation. Incision from the anal opening to the coccyx, and the latter removed under cocaine. Incision carried along the line of the rectum to the curve of the sacrum, but the peritoneal cavity not opened. An abdominal opening then decided upon, and the colon opened midway between the anterior superior spine of the ilium and the costal border. Colon readily found, stitched with continuous suture, and punctured. The almost paralyzed bowel evacuated itself more by atmospheric pressure than by contraction. The first meconium was sticky and came slowly, a little later it came more freely, but not as if through peristalsis.

Temperature at the time of operation 101°, rose gradually to 105°. Child died the following day.

Autopsy. The entire colon above and the sigmoid below were quite full and distended, small bowel empty. The termination of the rectum was very close to the end of the perineal wound. Had the incision gone half an inch deeper it would have struck it.



NOTE.—The feeble condition of the child may account for the fact that the bowels were not emptied, but the suggestion that has been made of an opening in or near the median line would have secured the sigmoid and made a better artificial anus. The 2 per cent. solution of cocaine rendered the operation painless.

A METHOD OF TREATMENT FOR THE RESTORATION OF ENTIRE TIBIÆ NECROTIC FROM ACUTE OSTEOMYELITIS.

BY HAYWARD W. CUSHING, M.D.,
BOSTON.

ACUTE osteomyelitis is not a disease with which surgery is unfamiliar. The rapidity with which it kills, the deadly character of the infection, and the excruciating torture which its victims suffer make an impression which once experienced is never forgotten.

The clinical facts are well known and have been often recorded. They are: That it occurs most frequently in children and young adults; in the long bones, especially in the tibia; and is due to infection. That acute toxæmia promptly occurs, produced by a septic thrombo-phlebitis; that infected emboli, metastatic abscesses, and pyæmia rapidly follow. If the patient is not killed at once, drainage, either spontaneous by abscess formation or by operation, may relieve the condition; but the bone is doomed, and is rapidly killed by interference of circulation, by thrombi, or extreme irritation by toxins.

Modern surgery has learned to recognize these cases early; also, that toxæmia can be stopped by prompt treatment and free drainage. The patient's life is saved, but with a dead shaft to be subsequently dealt with.

The natural process of repair is by the formation of new bone from the periosteum of the old shaft, which passes through the various stages of reactive inflammation, formation of granulation tissue, gradual separation of the dead bone, and formation of the sequestrum; the appearance in the granulation area of osteoblasts, the formation of bone trabeculæ, calcification, for-

mation of the involucrum, and a new diaphysis, which in cases of central necrosis surrounds and shuts in the sequestrum with a shell of new bone. This becomes as dense and hard as ivory. It is usually lined with ill-nourished granulation tissue. The sequestrum lies free in it while drainage takes place through sinuses which require months or years to heal, and sometimes never close permanently.

To remove the sequestrum in such a case, close the resulting defect, heal the sinuses, and leave the patient a useful limb, has been one of the difficult problems of surgery.

Many methods have been followed, among which may be mentioned the routine opening of the cavity in the new shaft, removing its contents, and trying to cause the resulting defect to be healed and closed by granulation—a result rarely accomplished. More promising have been the operation of Hamilton's sponge graft, Neuber's skin-flap method, Schédé's blood-clot organization, and Hahn's modification, or Senn's implantation of decalcified bone-chips.

The more these cases have been studied and the more the knowledge of the pathological histology of the process has increased, the greater has been the tendency to operate earlier. Discouraged by the long course of these cases and unsatisfactory results, some surgeons have operated at once and removed the shaft of dead bone in the acute stage while operating to establish drainage and avoid the danger of immediate death from acute septic intoxication. It was known that the process of repair would produce new bone, and it was hoped that in this way a new shaft would be formed. It was found possible to shell out the entire diaphysis at this time, and it is now occasionally done. The subsequent results have not been, as a rule, satisfactory. I have made an effort to learn the final results in these cases of early complete sequestrotomy, but have found it quite difficult. In the few cases I succeeded in collecting, only one, a case of ablation of the tibia, was found to have a useful leg. The others had either bones not rigid enough to perform their normal function unaided by apparatus or had suffered amputation. Cases are on record where the regeneration of a

diaphysis has occurred after ablation of a necrotic shaft, but the above is my personal observation.

In 1896, after a study of the pathological histology of osteomyelitis and a careful review of the valuable work of Dr. E. H. Nichols,[1] it seemed to me that better results might be obtained from early sequestrotomy if in any way the proper time for operation could be accurately and intelligently determined.

The facts seemed to show that an operation done too early injured the new periosteum and interfered with the regenerative process. If delayed too long this process of regeneration was advanced so far as to shut in the necrotic shaft by a bony wall, analogous to the rigid cicatricial base of an old ulcer, so dense as to prevent the growth of any tissue having vitality enough to repair and close the defect, resulting from the removal of the sequestrum.

From the experimental work of Dr. E H. Nichols it is shown that the most favorable time for such removal would be at that stage of regeneration just previous to the extensive formation and coalition of the bone trabeculæ of the periosteum and new formed granulation tissue—a time when osteoblasts were abundantly present, when the lime salts were beginning to appear, but before the trabeculæ were extensively calcified. It seemed possible that if small sections of the periosteum could be examined histologically from time to time, the regenerative process could then be watched until it was positively shown that the above condition or stage was reached. At such a time I could remove the dead shaft with a knowledge that I would leave behind a sheath of granulation tissue and periosteum in the most active stage of bone formation. If such a sheath could be freed from sources of infection and could be closed by sutures I could then bury in the centre of the leg, by closure of the soft parts and the skin over it, a solid cord of bone-producing tissue, and in which there would be no chance for the formation of those

[1] "The Pathology of Acute Infectious Osteomyelitis," by Edward H. Nichols, M.D. Medical communications of the Massachusetts Medical Society, 1898, vol. xvii., No. 3, p. 875.

rigid-walled bony cavities so difficult to heal after the usual operation of sequestrotomy. A solid bone would be formed, also the primary union of the soft parts by the proposed method would be of great benefit to the patient by shortening the period of confinement to bed, and by avoiding the depressing effect of long-continued suppuration.

In 1897 I had an opportunity to test this method, and the result has been so satisfactory that I feel justified in putting it on record and asking a trial of it.

The patient was a boy, sixteen years old, and well at the time of the attack. The infection was supposed to be the result of a blow received while skating. The left tibia was the seat of the disease. The symptoms developed rapidly after the injury. There was intense pain, tenderness, marked constitutional disturbance, and delirium. The condition rapidly became such that the patient's life was in great danger. At the end of the first week the swelling of the leg at the lower epiphyseal line indicated that the bone and periosteum were perforated, and at the end of the second week the spontaneous opening of the abscess established drainage, and the patient had a chance for his life.

The first time I saw him was two weeks later (January 28, 1897), on the twenty-eighth day of his illness. He was delirious, emaciated, very pale, and extremely weak. He was reported as having slept during the past four weeks only while so utterly exhausted that the intense pain could not rouse him. The left tibia was evidently necrotic throughout. There was drainage through a sinus just above the internal malleolus; also an abscess (swelling, redness of surface, fluctuation) near the tubercle of the tibia. The leg was swollen, brawny, œdematous, dusky red, and exquisitely tender.

The abscesses were at once opened freely and curetted, the openings into the medullary canal enlarged, free drainage established, and the struggle for the patient's life began. A bacteriological examination showed the presence of the staphylococcus pyogenes aureus. As a result of the free drainage, stimulation, and constitutional treatment the patient began to improve, and a week or ten days later was out of danger.

The condition of the bone was carefully watched. At the time it was exposed at the site of the abscess, on the twenty-eighth day, it was

dull white and dry. The wounds gradually cleared off as the abscess wall began to show granulations, and later the bone appeared as a white area at the bottom of the cavity, surrounded by the red granulation zone. About February 6th a small section of the granulation area at the edge where it covered the bone was removed and examined. On February 20th a second piece was examined. This, although having macroscopically the appearance of ordinary granulation tissue (color, vascularity, and density), was found histologically to contain numerous osteoblasts, and many trabeculæ, some showing distinct calcification. This explained a slight crackling sensation, which was noticed when the section for examination was excised, as the knife divided the tissues, and which was probably due to these minute trabeculæ being crushed.

The time had now arrived to remove the dead shaft of the tibia. This was done when the report of the examination of the section was obtained, which was on March 5th, the sixty-fifth day of the disease.

The leg was made bloodless by the Esmarch method. In addition to the usual preparation, the leg was scrubbed just before the operation with soap, hot water, and ammonia, irrigated, wiped with ether, and finally scrubbed with a 1 per cent. solution of corrosive sublimate. The sinuses were irrigated with peroxide of hydrogen and then with sublimate solution 1 : 3000. The granulations about the sinuses were burned away with a cautery tip. The tibia was exposed by a cut along its anterior surface the entire length. The knife crushed easily through the softened bone cortex at the upper end. The process of disintegration seemed to be more marked at the extremities than in the middle of the shaft. The periosteum was now separated from the dead tibia with elevator and chisel. It peeled off readily as a rule. It varied in thickness from one-thirty-second to one-fourth of an inch, being thinnest over the middle portion of the bone. It was covered in places by scales or thin patches of calcified tissue, which were adherent to its osseous surface. Some of these areas were two inches long.

When free of periosteum the bone was divided at its centre and the halves turned out, thus separating or breaking them away from the epiphysis. The necrotic process was found to have extended into the epiphysis nearly to the joint surface at both the knee and the ankle. At these points the process of calcification of the involucrum was so far advanced as to form a rigid wall around the necrotic area. This was removed as far as possible without opening the joint or destroying the epiphysis any more than was necessary to reach normal medullary

tissue. The calcified areas alluded to on the inside surface of the periosteal sheath were now removed, leaving that tissue flexible. All the suppurating surfaces of the sinuses and the abscess cavities in the soft parts were now removed by cautery, curette, and irrigation (sublimate solution 1 : 3000).

The periosteal sheath, which was, of course, united to the superficial structures, was now closed by deep silk sutures throughout its entire length, thus obliterating completely the space previously occupied by the necrotic shaft. A solid cord of periosteum in the most active stage of bone production was thus placed, buried, in the centre of the leg. The old sinuses, after removal of their walls by dissection to remove all infected tissue, were plugged with iodoform gauze. The defect in the upper epiphysis was treated by the Schédé method.

The tourniquet was removed after the dressing was applied. This was made rigid by a plaster-of-Paris bandage.

The patient did well. The rapid improvement in the general condition was quite striking. Three days later the incision was inspected, on account of a musty odor, but the Schédé dressing or the iodoform packing were not disturbed.

On the seventh day the sutures were removed; the wound was united except at the lower portion. One or two sutures showed slight suppuration at the points of puncture in the skin.

On the eighteenth day the tibia had reformed apparently and was nearly as firm as normal.

On the twenty-third day after the operation the patient could lift the leg from bed, as it was so rigid. The new bone appeared to be one-half to two-thirds larger in diameter than the tibia of the right leg.

On the forty-ninth day the shaft was apparently normal in size and density. It was firm except at the lower epiphysis, where there was a small sinus (diameter No. 12, French). There was also a small sinus at the upper epiphysis.

On the fiftieth day (April 24th) the patient was etherized and the sinuses examined. The lower one was found to enter a cavity which occupied nearly the whole of the lower epiphysis. There was fibrous union with the shaft, but the cavity was shut off from it by dense, firm, granulation tissue partly calcified. This epiphyseal cavity was curetted, leaving a hole with dense bony walls. An attempt to obliterate this was made by forming a rectangular osteoplastic flap of the external wall of the malleolus, which was then depressed into the defect, which

it fitted fairly well. The wound in the superjacent tissues was now sutured without drainage. The upper sinus was opened, curetted, and closed by suture.

The upper wound healed at once; the lower nearly so, except a small granulating surface.

On May 24th (twenty days after the second operation) both cavities were apparently filled (the upper by the organized clot, the lower with the bone flap) and ossification begun.

On May 23d (twenty-nine days after the second operation) the lower sinus reopened and was two and one-half inches deep. The patient was up and about on crutches. The leg was supported by a posterior skeleton wire splint, which extended from the toes to the groin. Later the upper sinus reopened. Cultures from the upper showed staphylococcus aureus and albus; from the lower sinus staphylococcus albus only.

On July 15th the lower sinus was explored again. It was found to connect with a bony cavity containing a small sequestrum. This was removed, the cavity curetted, the sinus in the soft parts dissected out, and the wound closed with a catgut suture. The upper sinus was found to involve the soft parts only, and did not connect with the bone. Both sinuses healed The upper one remained so, but the lower one reopened in August. It remained so for a time, but gradually closed again.

In October the patient was well and about, with splint and crutches. The patient, after August, 1897, grew very stout and heavy. Had he been less careless and stupid, so he could be trusted to take proper care of his leg, he could now probably have been allowed to go without apparatus. But on account of this lack of intelligence it was not considered safe to do so, and the splint and crutches were continued.

April, 1898 (thirteen months after the removal of the tibia), the apparatus was discontinued and the patient allowed to use the leg unsupported. The bone was quite firm; the leg was one inch shorter than the right. There was a depression of the soft parts just above the internal malleolus.

Skiagraphic examination shows the bone straight and thinner than the right tibia, but the left fibula was also smaller than the right.

In March, 1899 (two years after the removal of the tibia), the patient again was examined. He is well, strong, and heavy; walks unaided and without difficulty. There is one and three-fourth inch

of shortening. The bone is firm. The patient can stand with his entire weight supported by his left leg. On account of the inequality in the length of the legs the pelvis is tilted and there is a slight lateral spinal curve. This is shown in Plate 1 by the position of the iliac crests and the shoulders.

The radiographs, Plates 3, 4, 5, show the bone intact, with a distinct cortex and medullary cavity. A lighter shadow is noticed in the shaft just above the malleolus and in the lower epiphysis, where the process of repair was delayed, and probably the calcification is less in amount.

Present Treatment. The patient wears a shoe with the sole one and three-fourth inches in thickness on the left foot, to prevent scoliosis of the spine.

SUMMARY. The indications for treatment in cases of acute osteomyelitis are:

1. To save the patient's life and relieve pain by immediate operation, to establish free drainage. The medullary cavity should be opened, pressure relieved, and infection checked.

2. If the bone is killed, as it usually and rapidly is in a few days, it should be removed.

3. The most favorable time for its removal is when the periosteum and granulation tissue is in its most active regenerative stage, but before the process of calcification of the bone trabeculæ have shut the sequestrum within a compact dense shell of involucrum.

4. This point is to be determined by frequent examinations of sections of the periosteum with the microscope. It is shown by the presence of numerous fibroblasts, osteoblasts, and small trabeculæ in which lime salts are beginning to be deposited.

5. Clinically, it can be recognized by the slight crackling sensation as the periosteum is incised, due probably to the crushing of the trabeculæ by the knife.

6. The periosteum at this stage resembles granulation tissue in color, density, and vascularity. There is no macroscopic appearance of ossification. Bone will be formed from this elastic flexible periosteal layer.

7. This stage in this case was probably reached in the seventh to eighth week of the disease.

8. At this stage the necrotic bone should be removed by incising the periosteum in the long axis of the leg and shelling out the sequestrum.

9. The periosteal sheath remaining should be closed by suture, leaving a solid cord or mass of periosteum buried in the centre of the leg when in its most active bone-producing condition.

10. If areas of calcification of any extent or thickness are found adherent to the inner surface of the periosteal sheath they should be dissected off.

11. The soft parts and skin superjacent can be closed by suture.

12. The utmost care and most efficient means should be used to render the operation an aseptic one, for primary union is important.

13. The new bone is formed rapidly, apparently in eighteen to twenty-four days when the operation is done at the time above indicated. At this time ossification is so advanced that the new bone is rigid.

14. If the operation is done too early the growing periosteum is injured apparently and its growth interfered with.

15. If too late a rigid bony involucrum makes the removal of the sequestrum more difficult and forms a cavity which is very difficult to close.

16. It is demonstrated by the radiograph that the medullary cavity is reformed in the new bone.

17. The shaft of the bone is easier to restore than the epiphyses.

Description of Plates.

1. Shows patient. Note the lateral spinal curve and tilting of the pelvis, due to the shorter left leg.

2. Shows the strength of the new tibia. Patient stands on one foot with the entire weight of the body supported by the new bone.

3. Radiograph. Shows both right and left legs.

4. Radiograph. Shows upper half of left leg.

5. Radiograph. Shows lower half of left leg. Notice the lighter shadow in the shaft of the tibia just above malleolus and in the epiphysis, which was so long the seat of the carious process, possibly due to less complete calcification.

These plates show the condition of the patient on March 28, 1899, two years after operation.

PLATE I.

PLATE II.

PLATE III.

PLATE IV.

PLATE V.

I. PRIMARY MYXOSARCOMA OF THE OMENTUM.

II. LARGE PERINEURAL FIBROMA OF THE SCIATIC.

BY RUDOLPH MATAS, M.D.,
NEW ORLEANS, LA.

CASE I.—*Primary myxosarcoma of the great omentum; laparotomy and extirpation of the neoplasm involving the entire omentum with secondary growths; second laparotomy nearly fifteen months after first operation, to relieve myxomatous ascites caused by recurrent generalization of growth throughout the peritoneum; death from exhaustion and marasmus twenty-four days after operation.*—B. F. V., a white man, aged forty-six years, native of Louisiana, and farmer by occupation, was admitted to the medical service of Prof. Reynaud, Charity Hospital, in November, 1896. He was transferred to my surgical service December 16th. The family history of the patient revealed excellent hereditary antecedents. His parents were Americans of Scotch-Irish descent. The mother died of heart-disease at the age of seventy; the father at fifty-three, from pneumonia. He had five brothers, one of whom died in childhood from some obscure fever; the others are living and well. The patient is the father of ten children; five of these are grown up, married men; four are robust healthy minors, and only one, a male child, died from a malarial affection of an unknown type.

Personal History. The patient has always enjoyed the most robust health. Has never been ill except a few days before admission, when he was sick with malarial fever and an obscure form of colic of short duration. He sustained some injuries of the back and forehead in 1882, but these were followed by no notable consequences. He has been a man of very regular, methodical life; he does not touch alcoholic drinks; has used tobacco in moderation, but drinks much coffee. Six years ago he "strained" himself while hauling a beef that had been slaughtered, and dates the beginning of his ill-health to that

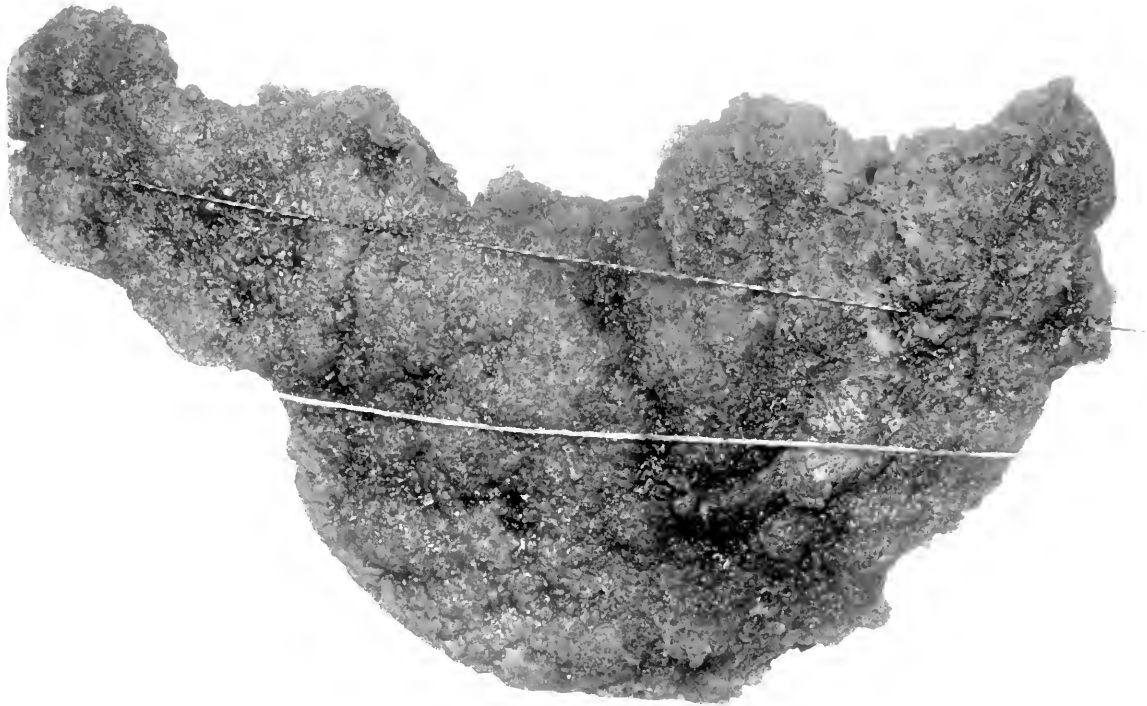
time. Not long after this occurrence he began to notice that his digestion was painful and that the "pit of the stomach" became abnormally distended after ordinary meals. He occasionally felt nauseated, and vomited after eating. His bowels always acted regularly.

History of Present Illness. Three years before admission he noticed that there was an unusual permanent fulness of the abdomen above the "navel," and he soon felt a lump at this point, which painlessly but gradually increased in size. He had always been a man of full habit and heavy weight; his average weight was nearly 200 pounds, but when admitted to the hospital he had already depreciated in weight and strength; he then scarcely weighed 140 pounds. When admitted to Dr. Reynaud's service he was subjected to repeated and careful examinations. He was found to be sound everywhere except in the abdomen. Here a distinct irregular ovoidal mass was seen and felt projecting through the abdominal walls in the epigastric and umbilical regions. The tumor was hard and yet semielastic and quite movable. It could be shifted to either side of the abdomen and downward toward the pelvis, but it rested usually in the umbilical and hypochondriac regions. The pulsations of the aorta were transmitted through the tumor. There was absolutely no pain, no tenderness on pressure, no nausea, no vomiting during the most thorough manipulation. The mass was felt immediately under the abdominal wall as it floated about, apparently over the intestines. There was also some ascites. The patient never complained of colic or vomiting, and the tumor caused no interference with the digestive functions.

A careful analysis of the gastric contents, made by Dr. J. Storck, yielded absolutely negative results. The amount of free HCl was normal; the only abnormality reported was a slight dilatation of the gastric contents, but the mobility and absorbent capacity was normal, as shown by the salol and K.I. tests. The urine was normal in quantity.[1] The general appearance of the patient, apart from the emaciation referred to, was good. The complexion was fair, perhaps tanned by the sun and exposure There was a slight subicteroid tinge of the scleræ. The spleen was not enlarged. The central position of the tumor, its mobility, large size, slow growth, its painlessness, its non-interference with the visceral functions were its most marked features.

[1] Repeated examinations revealed always an excess of mucus, marked acidity, high specific gravity (1026), but no other abnormalities except a trace of bile-coloring matter.

PLATE I.



Primary myxosarcoma of the omentum. Gross specimen.

The conclusion arrived at was that the growth was probably a benign neoplasm attached to the wall of the stomach, colon, mesentery, or omentum. As the precise nature of this growth could not be determined from the simple clinical data an exploratory laparotomy was advised and accepted by the patient. On December 19, 1896, the operation was performed before the class of the Medical Department of Tulane University.

Operation. A median incision two inches in length was made below the umbilicus. Upon opening the peritoneum fully a gallon of a clear yellowish serum containing many floating particles of a transparent gelatinous substance escaped. The exploring finger at once touched a large, resisting, friable, shaggy mass, which was spread over the intestines and appeared to cover a large part of the abdomen. The incision was enlarged and the tumor was identified with the omentum. By increasing the length of the incision above the umbilicus the entire tumor, with part of the stomach, to which it was attached, was delivered. It involved the entire great omentum and was connected to the whole length of the greater curvature of the stomach, the spleen, and the colon. An outgrowth of the tumor involved the lesser or gastro-hepatic omentum, and another entirely independent mass, as large as a fist, was adherent to the ileo-cæcal junction, forming a part of the mesentery, but floating in the peritoneal fluid. The existence of ascites was partially explained by the compression of the vena porta, which was entirely enveloped in the mass at the transverse fissure. The large omental mass was delivered and removed *en bloc*. It closely resembled a very large outstretched flat sponge, of the kind used in abdominal surgery and known as "elephant's ear." The accompanying photograph (Plate I) gives a fair idea of its gross appearance. It had a yellowish-red color, and consisted of a thin, friable trabecular stroma, which enclosed in its meshes a translucent, gelatinous matter. The original tissue and fat of the omentum had been apparently supplanted by this gelatiniform substance. In form, the tumor presented an irregular triangular appearance, which measured in its longest axis (transversely) about 12 inches (30.5 cm.) and vertically 5 inches (12.5 cm.). It was thickest in its central portion below its attachment to the greater curvature of the stomach—1½ inches (6.4 cm.)—and weighed nearly 1¼ pounds. It was so rigid and friable in consistence that whole blocks could be broken off with the fingers. Its lack of vascularity was remarkable. It was easily detached from its connections with scarcely any bleeding. Only four important trunks arising from

the gastro-epiploon arch required ligation. The detachment was effected chiefly by gently pulling upon the growth and tearing the gastrocolic connections with the fingers. The shaggy masses that were attached to the gastrohepatic omentum and the ileocæcal region were removed, but it was found impracticable to extricate these masses in a clean surgical fashion, because of the important structures to which they adhered; flocculent shreds and tatters of myxomatous tissue were, therefore, left behind in these places.

The operation consumed over forty minutes. In view of the extensive manipulations required and the free handling of the abdominal contents, the abdomen was repeatedly flushed with decinormal saline solution and a drain of iodoform gauze was left in the umbilical region. The abdominal wound was then closed throughout except at the drain exit. The patient stood the operation remarkably well and suffered very little shock, owing, probably, to the total absence of hemorrhage. He was taken to the ward in excellent condition. On the third day the gauze drain was removed. The wound healed kindly without suppuration, and the post-operative course was normal and without notable incidents. The patient left the hospital, feeling very well and gaining flesh, early in February, 1897.

. . . . . .

After his return home he at once went to work on his farm, and continued to labor in the field uninterruptedly for two months, when he had to give up his occupations because his abdomen became distended and "dropsical." Between May, 1897, and February 9, 1898, he was compelled to rest, in consequence of growing weakness and the discomfort caused by the increasing abdominal tension. On three occasions he attempted to relieve himself by puncturing the abdomen with a penknife at a point where the scar of the abdominal incision had become thin from the great intraperitoneal tension. He relieved himself considerably in this way, though not as much as he expected, because the punctures were followed by the escape of a thick gelatinous material, difficult to squeeze out, and not a watery fluid, as he anticipated. Nevertheless, he secured some temporary relief from the punctures, because by his own efforts he was able to force out enough of this gelatiniform substance to diminish the peritoneal tension. No evil effects followed these heroic but crude tappings. The penknife used was not in the least aseptic; it was merely sharpened, and yet no infection followed, and the wounds healed readily.

He was suffering very much from abdominal distention and weakness when he came back to us in February, 1898. The abdomen was then very hard, uniformly distended, and no outline of new growths or deposits could be made out. The umbilical centre of the cicatrix protruded in a conical form, as if herniated in consequence of the greater weakness of the scar at this point. His body was considerably emaciated, and he had lost over forty pounds since his recovery from the first operation. His appearance suggested that of an advanced case of hepatic cirrhosis. He was kept under observation three weeks, during which time he was carefully nourished with appropriate food, strengthened with strychnine and stimulants. Purgatives had no effect upon the ascites. His digestion was remarkably good, his appetite excellent, his bowels acted well and regularly; he never vomited. There was no œdema of the extremities. An attempt was made (March 5, 1898) to diminish the ascites by tapping, but notwithstanding the large size of the canula and the several punctures made at different points, nothing escaped, as the canula was kept plugged with long masses of the gelatiniform substance which appeared to fill up the whole cavity.

Finally, on Thursday, March 10, 1898, I reluctantly yielded to the patient's constant entreaties to do something for his relief, and reopened the abdomen by a free abdominal incision in the line of the first scar. The incision, three inches in length, laid open the umbilical projection in its most prominent point, and immediately exposed a large space resembling a hernial sac, which was bounded by the abdominal walls laterally and the adherent intestines posteriorly. This space was filled with myxomatous substance (so-called colloid matter). This substance was semifluid, tenacious, ropy, and whitish-yellow, and looked very much like jelly or thick intestinal mucus. It was a little rosy in places, as if minute extravasations of blood had tinged it. It had the consistence of jam. There was absolutely no effusion of real serum in the peritoneum, but pressure on the abdominal walls, made on all sides by assistants, forced out large quantities of the thick myxoid matter. It was found that the intestines, which were remarkably empty and small, had become adherent near the original incision and between themselves. The adhesions in turn were everywhere infiltrated with the gelatiniform substance. By introducing the hand and forearm through the enlarged incision I explored the abdomen and found that the entire pelvis, the lumbar, and especially the right and left hypochondriac regions, were densely packed with this strange

substance. An immense amount of this material had accumulated between the liver and diaphragm and under the liver, in the lesser cavity of the peritoneum. Handful after handful of this material was scraped and pressed out until more than a large bucketful had been removed. It was then observed that the liver was literally embedded in a magma of this substance, which was thicker and more tenacious here than in other parts. The subphrenic space contained several pounds of this material, the liver itself being contracted, shrivelled hard, and was so small in size that it was scarcely larger than the two closed fists of a grown man put together. The liver was so brittle that pieces of its edge could have been easily broken off had I tried to do so. What remained of the organ was deeply fissured everywhere, as in progressive syphilitic disease or in the most advanced stage of atrophic cirrhosis. The wonder was not only that the man's digestion was so good, but that he had lived so long. That he secreted a sufficiency of bile was demonstrated by his stools, which were of a normal brownish color, nor was he jaundiced to any notable extent. The intestinal mass was everywhere covered with adhesions, which in turn were embedded in and infiltrated with this myxomatous glue.

To facilitate the removal of this glue I made an additional incision in the right hypochondrium, following the lower edge of the costal arch posteriorly, and tried to dissolve and wash out the excess of gelatinous matter by copious peritoneal irrigation with hot saline solution. The subphrenic space was thoroughly irrigated and mopped out, and considerable quantities of the mucoid magma were thus forced out of both incisions. Finally a large iodoform pack was inserted in the hypochondriac incision, but the median wound was sutured and closed permanently. The anæsthetic was Schleich's general anæsthetic mixture No. 2 (chloroform, sulphuric ether, petroleum ether), which he took well. Again the patient showed his remarkable vitality and extraordinary endurance by leaving the table without notable evidence of shock, and perhaps in better condition than when he was first brought to the operating-room.

In the evening after the operation he complained considerably of his bandages "being very tight." That night the temperature rose to 102°; pulse, 110. The next morning the patient was better (temperature, 99.5°; pulse, 100). The temperature on the third day after the laparotomy rose again to 103°; pulse, 140; and he vomited fre-

quently. We feared that he would die from septic peritonitis. The dressings were then removed and the wound examined for the first time. The cause of the septic symptoms was found in a small streak of fecal matter that appeared between the sutures in the anterior wound. The sutures were immediately removed at this point and some more fecal matter made its appearance, but very little at a time. Carefully washing the surface and cutting the sutures to explore more readily, we failed to discover any direct communication with the bowel. A wet carbolated dressing was applied and constantly changed. The abdomen became tympanitic and very tender to the touch; peristalsis was arrested, but there was little vomiting. Purgative enemata of salts were administered, and the usual stimulant hypodermatic treatment was resorted to, with the result that the bowels moved and the temperature fell to 99.5°, but the pulse remained rapid (130 to 135) and small. On Monday, the fourth day after the operation, all the sutures of the anterior abdominal wound were removed and careful search was made for the opening in the gut. In spite of long and diligent search no leak could be discovered in the bowel in the immediate vicinity of the median incision, where new and strong adhesions had formed. It was evident, therefore, that in detaching fragments of the growth and in separating old adhesions a rent in the small intestine had been made somewhere in the vicinity of the abdominal incision, but the gases and fecal matter were, fortunately, prevented from invading the general cavity by the existence of old adhesions and rapid formation of new ones. An evident fecal fistula was thus created which gave rise to a localized infection. In view of the impossibility of finding the intestinal opening, the wound was allowed to remain open and the irregular tract that presumably led to the leaking bowel was carefully plugged with gauze. The edges of the wound were covered with powdered bismuth subnitrate, as a dermatitis had developed from contact with fecal matter.

After the third day all vomiting ceased and the patient was stimulated and fed by the mouth. From this on to his last hour he retained everything that was given to him by mouth. The fecal discharge continued for about ten days from the date of its first appearance. It was never a free or abundant flow, but sufficient matter escaped to stain the dressings, the bowels acting regularly through the normal channel. On the tenth day it closed spontaneously and the anterior wound immediately began to improve. The incision in the right hypochondrium, which had been originally left open and drained with

iodoform gauze, also became infected and discharged a considerable quantity. The infection was also localized in this wound by adhesions of pus, but no fecal matter ever escaped from it. The wounds had improved and were healing rapidly, when, in spite of the closure of the fecal fistula, the patient gradually grew weaker, more marasmic and cachectic, and finally succumbed in sheer exhaustion, on April 7, 1898, twenty-eight days after the last intervention.

A careful post-mortem examination was made by Dr. O. L. Pothier, the pathologist of the hospital, on April 7, 1898. As the body was claimed, only the abdomen was opened. The abdominal organs were found so adherent and densely enveloped in myxomatous magma that they were removed *en masse*. There was no trace of the great omentum; it had all been removed in the first operation. The weight of the stomach, liver, spleen, pancreas, and bowels, put together, was sixteen pounds. The liver was very much atrophied, contracted, and hard. Marked evidences of old perihepatitis and sclerogenic changes with myxomatous infiltration of the capsule existed. The vena porta was surrounded by a complete dense atmosphere of myxoid glue. The spleen was very small, hard, and typically cirrhotic, and also enveloped in the same material. The stomach and intestines, as well as the abdominal organs, including the kidneys and pelvic contents, were embedded in the same material, which had evidently reproduced itself rapidly throughout the peritoneum since the last operation. The left scrotum contained the sac of an old inguinal hernia, which was tensely filled with the same clear translucent gelatiniform matter. The sac was practically closed at the neck and was free from visceral contents; it contained over one pint of clear myxoid material.

Careful sections of the omental tumor were prepared and mounted by Dr. Pothier, from which the accompanying photomicrograph (Plate II) was made. The examination of the sections prepared from typical specimens showed that the original or primary omental tumor was a typical myxosarcoma, and that the amorphous gelatiniform matter which filled the peritoneum was essentially a semifluid mucoid tissue presenting all the histological characteristics of the Whartonian and vitreous jelly.

"The examination of the section of the omental tumor shows that it is made up entirely of myxomatous tissue, which is distinctly fibrillated in places, amorphous in others, and of islands consisting of round cells of sarcomatous tissue. In some sections these islands or areas of sarcomatous infiltration occupy the greater portion of the

PLATE II.

Photomicrograph of section of myxosarcoma of omentum. Taken with obj. 1 5, Bausch and Lomb × 500. The part marked I shows the details of the myxomatous tissue and the islands of sarcomatous cells. The specimen was fixed and hardened in alcohol with 5 per cent. formalin, and carried through the different grades of alcohol, and then ether, and blocked in celloidin for cutting. (Prepared by Dr. O. L. Pothier, Pathologist, Charity Hospital, New Orleans).

section; in others they are disseminated throughout the mucoid stroma."—*Extract from Dr. Pothier's report.*

In summarizing this unusual case I would call attention to the following salient points:

1. A primary myxosarcoma of the great omentum in a previously healthy adult, male subject, aged forty-six years, which had existed apparently without very serious inconvenience for nearly three years before surgical relief was sought.

2. The practical difficulties which attended the diagnosis of the tumor, the nature and exact localization of which was not positively recognized until an exploratory operation was performed (December 16, 1896).

3. Laparotomy with removal of the entire neoplastic omentum and metastatic deposits, from which the patient recovered promptly without notable shock or post-operative complications.

4. Recrudescence of the growth at various metastatic points and development of a myxomatous ascites (by rapid transformation of ascitic accumulation into a typical myxoid glue), which greatly distended the abdominal cavity.

5. Attempted relief of peritoneal distention by the patient himself, who, in the interval between May, 1897, and February, 1898, punctured his abdomen three times with the point of a penknife. Each puncture (made in the most distended portion of the abdominal cicatrix) served to evacuate a certain amount of gelatiniform material and afforded temporary relief, and was not followed by infectious complications.

6. Repeated attempts made to tap the patient (March 5, 1898) with a large trocar and canula failed totally to give relief, owing to the constant plugging of the canula with thick myxomatous material.

7. Secondary laparotomy to relieve the myxomatous ascites March 10, 1898 (nearly fifteen months after first operation), in the course of which over two and one-half gallons of thick ropy gelatiniform material were removed.

8. Development of small fecal fistula in the abdominal incision

from accidental tear of adherent intestine; spontaneous closure of the same on the tenth day after operation.

9. Death from marasmus and cachexia twenty-five days after last operation.

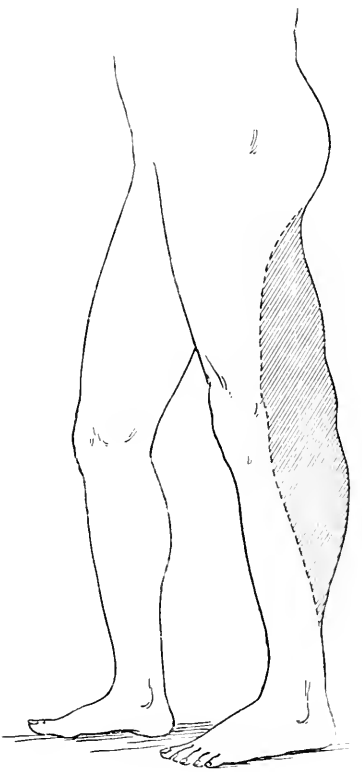
10. The autopsy and histological examinations confirm the diagnosis of primary myxosarcoma of the omentum and reveal a general atrophic and cirrhotic condition of the abdominal organs, more especially of the liver and spleen. These organs were contracted to a remarkably small size in consequence of a progressive sclerogenic process beginning in the capsule, the organs being embedded in a magma of myxosarcomatous tissue, which appeared to have invaded their capsule, but not the parenchyma.

The simple serous ascites which was recognized in the first operation was not due primarily to mechanical compression of the porta and its radicals by the early metastases from the omental tumor, but, in all probability, to some alteration in the serosa itself. The secondary myxomatous ascites which rapidly followed the first laparotomy was due, in all probability, to direct general metastatic infiltration of the peritoneum itself, and also, mechanically, from secondary sclerogenic contraction of the liver. It appeared as if the ascitic serum became transformed almost immediately into mucoid material the moment it transuded into the peritoneal cavity, suggesting in this way the action of a ferment.

CASE II.—*Large perineural fibroma involving the entire sciatic nerve-sheath and deep femoro-popliteal fascia; extirpation of the tumor and popliteal vessels; recovery, with loss of toes and heel covering, from sloughing.*—The patient, C. B., a light mulatto, a native of Louisiana, aged twenty-two years; a steamship waiter by occupation. Distinctly tubercular on the maternal side. Personal history good as far as habits and previous diseases are concerned. No history of traumatism or other conditions that might suggest a cause to the present trouble. He was admitted to the Charity Hospital of New Orleans, April 1, 1898, for the relief of a large tumor of the right lower limb, which had gradually developed since the age of twelve (ten years' duration). The patient was pale, anæmic, marasmic from prolonged inactivity,

in-door life, and bad hygienic surroundings. The patient had been losing flesh progressively, and now weighed only 120 pounds, notwithstanding his height, which was six feet. The large size of the right lower limb is striking to the eye, on account of its great size, markedly contrasting with the opposite member, which was thin and atrophied. (See Fig. 1.) The affected limb was enlarged from the

FIG. 1.



lower gluteal fold to the toes. The enlargement was most marked posteriorly, where it projected in prominent relief from the femoral, popliteal, and crural regions. The tumor increased progressively in size from the tuberosity of the ischium to the centre of the popliteal space, where it attained its greatest dimensions, and from this point again decreased until it reached the malleoli. The leg and foot were

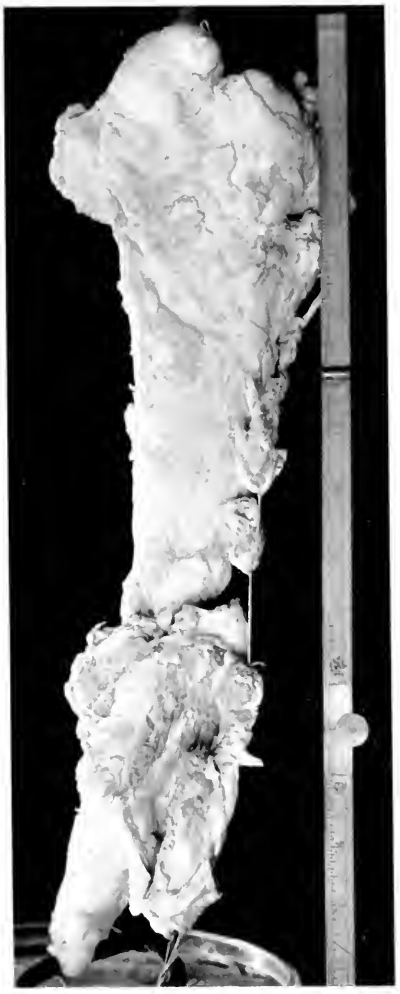
cylindrical in outline, the normal contour of the ankle having been obliterated by œdema. The œdema was evidently caused by mechanical compression of the popliteal vessels. The tumor originated primarily in the popliteal space as a slow, indolent, hard, painless swelling, which in no manner interfered with the function of the limb until three years ago, when it filled the space back of the knee so completely that flexion was impossible. About the same time it was noticed that the growth had extended up the thigh and down into the calf, but it was not until one year after that œdema and weakness of the leg began.

The actual length of the growth as it was felt through the skin was 42 cm. (17.5 inches), and it extended distinctly along the sciatic tract from the tuberosity of the ischium to the middle of the calf. It projected behind the popliteal space from one hamstring to the other, 21 cm. The circumference of the affected limb around the knee was 49 cm. (19.5 inches); on the sound side 36 cm. (or 14.5 inches). The same proportional difference was observed in comparing the normal and affected limb at various points in the circumference of the thigh and leg.

The skin overlying the tumor was thin, adherent, fixed, and immovable; the underlying mass was hard and nodular, especially in the popliteal space and calf. There was no pain on pressure or spontaneously. There was some œdema in the skin of the leg, and a small superficial ulcer above the ankle; no trophic lesions or disturbances of sensibility could be detected in the foot or leg. The neoplastic area was defined externally by a line drawn from the great trochanter to the external condyle of the femur and middle of the fibula; internally by a line from the tuberosity of the ischium to the internal condyle and middle of the tibia. Scarcely any motion was obtained by manipulation, the growth being very deeply rooted to the posterior ligament of the knee, sural and hamstring muscles and periosteum of the femur.

The large cubic fragment of tumor was removed from the popliteal space under cocaine anæsthesia, and the diagnosis of pure fibroma was established. On May 18, 1898, the tumor was extirpated *en bloc* by a careful dissection which extended from the tuberosity of the ischium to the middle of the calf; the incision measured about 54 cm. (about 24 inches). The tumor, which was a white, dense, extremely hard and resisting mass, had to be removed by a process of slow and tedi-

PLATE III.



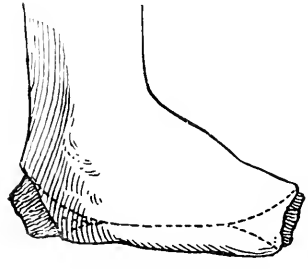
Peri-neural fibroma of the sciatic, involving the femoro-popliteal space.

ous dissection. It was impossible to enucleate or sheil it out of its surroundings; it had no capsule; it blended everywhere most intimately with its surroundings. When removed it measured over seventeen inches in length, and weighed a little more than three pounds. (See Plate III.) It was hard, bloodless, and creaked under the knife. The origin of the tumor from the sheath of the sciatic nerve was clearly ascertained, and the greatest difficulty was experienced in separating it from the nerve. In the popliteal space the mass had so completely wrapped itself around the popliteal artery and vein that all efforts to save these vessels had to be abandoned and more than three inches of each had to be removed. The artery being cut off right down to the level of the bifurcation, and with it part of the posterior ligament of the knee, with which the tumor had contracted inseparable adhesions, had to be excised, thus exposing the knee-joint. The peroneal and internal popliteal nerves had to be literally dissected—shaved off—from the mass in which they were embedded. The gastrocnemii and soleus muscles also intimately blended with the mass, at their origin, and part of these muscles, with the corresponding sural and articular branches of the popliteal vessels, had to be sacrificed. At this stage of the operation all hope of saving the foot and leg had been abandoned, believing that sloughing of these parts would be inevitable. Nevertheless, after securing all bleeding points and removing the constrictor, it was observed that the foot and leg gradually lost the waxy cadaveric appearance and that the color and sensibility of the skin of the foot had returned. All pulsations in the pedal arteries ceased, but the color of the skin encouraged us to hope that a sufficient collateral circulation existed, to prevent the total mortification of the leg. The limb was carefully wrapped up in a copious cotton-wool dressing, to keep it aseptic and warm, and the vast wound in the thigh and leg was closed with interrupted sutures and drained. A long posterior, padded, gutter splint (card board) immobilized the limb. The prophylactic hæmostasis was very complete and satisfactory. Before operating the limb was drained of blood by elevation and an Esmarch constrictor was applied high up over the groin and held in place by a Wyeth pin inserted above the great trochanter. In this way the constrictor was held up very high in the hip and prevented from slipping. Notwithstanding complete hæmostasis the shock was profound and the pulse ran up to 160 and was very feeble (the duration of the operation had been over one hour and a half). Three quarts of saline solution

were at once injected in the basilic vein and the pulse fell to 120 and became full and strong.[1]

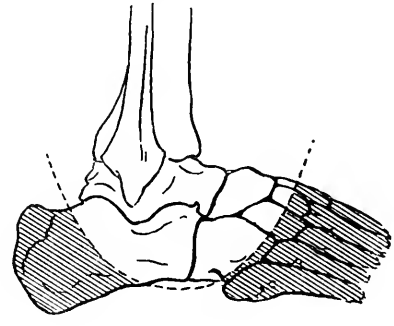
The next day the pulse stood at 140 and the temperature 103.5°. The foot, including the toes, could be moved freely by the patient, but all sensibility had left the toes and heel. The toes had also become markedly pale. Ecchymotic spots were noticed over the heel and in a small area over the tarsus. These spots, together with the toes, became subsequently the seat of a leathery, odorless, dehydrating mortification. The general condition of the patient rapidly improved, and three weeks after the operation the sloughed parts were removed with scissors. (See Fig. 2.) No attempt was made to shape the stump.

FIG. 2.



Sloughing of foot.

FIG. 3.



Line of osseous section.

The heel and toe surfaces were gradually covered with indolent granulations, but the healing process was very slow. Coincidentally with this indolent effort at repair, signs of trophic and vascular disturbance (viz., diminished sensibility, with redness and sweating in the sole of

[1] A careful examination of the tumor was made by Dr. O. L. Pothier, pathologist of the Charity Hospital, and many sections were cut from different portions of the growth. The bulk of the mass was found to consist "of a dense fibrous tissue of the adult type originating from the neurilemma of the sciatic and its branches." In many of the sections examined nerve-filaments were found very much distorted by a hypertrophic sclerogenic process, and totally surrounded by dense fibrous tissue. Here and there in the periphery of the growth, round, young, connective tissue cells could be recognized in a state of transition to the adult forms. The growth of the fibroid tissue had been in many places interstitial, but the tendency of the fibroid process had been to grow eccentrically and to invade the perineural connective tissue; this with the fascia and intermuscular septa soon participated in the process, and, in turn, attained huge proportions in consequence of progressive hyperplasia.

PLATE IV.

Appearance of the limb and cicatrix, showing the extent of the dissection required for the removal of fibroma of the sciatic. The appearance of the foot stump after healing is also shown.

the foot, accompanied by "burning" pains in the plantar surfaces, or "erythromelalgia") became pronounced, and annoying symptoms of neural lesion were unmistakable. Early in March, 1899, an atypical conservative operation was performed, with the view of remodelling the stump and providing a suitable covering to the heel and toe regions. An external curvilinear incision was made on the dorsum of the foot, extending from the tendo-Achillis behind to the base of the metatarsals in front. All the plantar structures were reflected in a single massive flap, including the vessel and nerves, from the skeleton of the foot, the bones of the tarsus being laid bare on the plantar surface. The skeleton of the foot was then reduced to the requisite size and shape by sawing the tuberosity of the calcaneum, part of the cuboid, and the cuneiform with the metatarsals. (The line of osseous section is indicated in Fig. 3.) In this way an ample covering of healthy plantar and dorsal flaps was obtained to cover the stump. In the course of this dissection the plantar nerves were exposed at their origin from the posterior tibial and stretched (as suggested by Chipault for the treatment of perforating trophic ulcer of the foot), hoping that by this procedure the erythromelalgia of the sole would be relieved. A very excellent, painless, and well-nourished stump resulted from this operation. The line of incision healed with remarkable rapidity and scarcely any suppuration. The vascular and neuralgic symptoms which had proved so annoying before the operation disappeared altogether, and the patient was soon able to leave the ward in excellent condition. He is now better than ever before, having gained remarkably in flesh and strength in consequence of his ability to enjoy out-door exercise. When he last called to see me, in April, 1899, he was able to walk on the stump without pain or inconvenience, and had good normal motion at the ankle-joint. It is quite possible that with further exercise he may still have a recurrence of trophic symptoms in the foot, as the amputation is too recent to test the permanency of the recovery, but the result thus far obtained is certainly strikingly favorable and most encouraging. (See Plate IV.)

The points of interest presented by this case are:

1. The existence of a perineural fibroma originating in and involving the entire sheath of the sciatic and its branches.

2. The diffusion of the fibroid process throughout the posterior aspect of the thigh and popliteal connective tissue planes,

without definite encapsulation, forming a hard, dense tumor of vast proportions.

3. The slow and painless growth of the tumor—ten years.

4. The involvement of the vascular sheaths of the popliteal bloodvessels in the tumor, which made it impossible to dissect the vessels out of the mass.

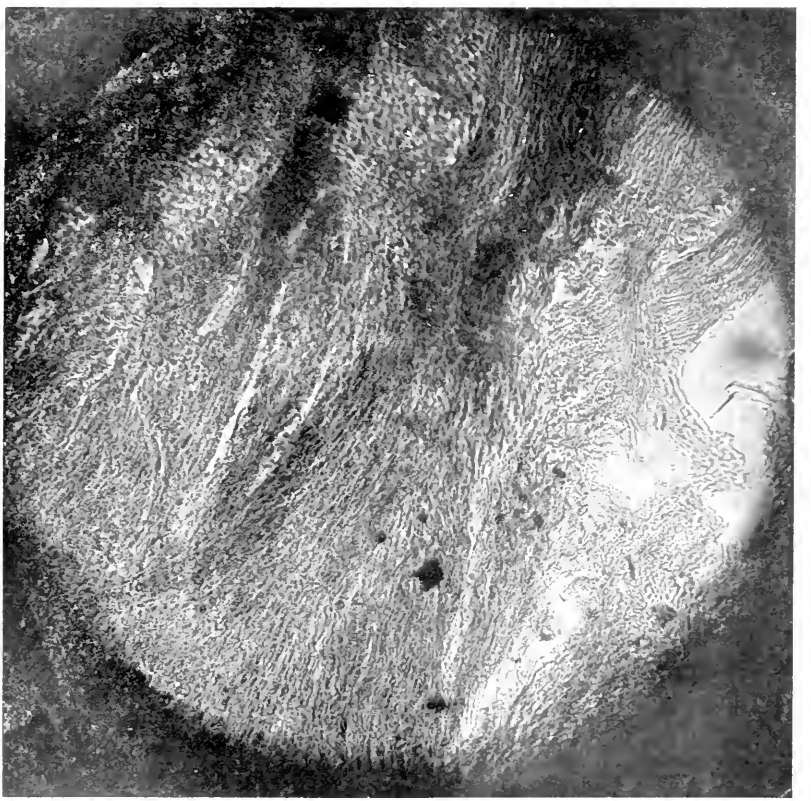
5. The extirpation of the tumor and excision of more than three inches (7.5 cm.) of the popliteal artery and vein.

6. The comparatively small area of peripheral sloughing (toes and heel) that followed the total excision of these vessels and many collateral branches.

7. The useful walking stump left to the patient, after a secondary partial and atypical amputation of the tarsus to remodel the stump.

8. The general good result as regards serious trophic lesions from injury to the sciatic nerve, which is an encouragement to conservative efforts in similar cases.

PLATE V.



Photomicrograph of section of fibroma of sciatic nerve.

THE "RIGHT-ANGLE" CONTINUOUS INTESTINAL SUTURE.

By HAYWARD W. CUSHING, M.D.,
BOSTON, MASS

THE ideal intestinal suture is the one which combines greatest rapidity in formation with maximum security from extravasation of intestinal contents. To fulfil these requirements there must be exact adaptation of wound edges and an accurate apposition of serous surfaces; also simplicity in construction, since ease in application means rapidity in operating, and adaptability to general use demands a technique uncomplicated, readily understood, and requiring only such materials and instruments as are commonly at hand or easily to be obtained.

A short experience usually demonstrates that "continuous" sutures have a great advantage in regard to the ease and rapidity with which they can be inserted. The time spent in knotting a fine wet thread, with fingers sticky with blood, in an intestine, difficult to hold as a wet rag, is surprisingly long.

It is true that some other sutures are usually firm, accurate, and handsome, but the extra time required to tie twenty to thirty knots is a very important factor in the success of an operation when the patient is rapidly approaching collapse. The result of my observations is that an intestinal wound can be closed from one-third to one-half more rapidly with a continuous suture than by any other that I am cognizant of. In 1886, after many experiments and an extended investigation of the best sutures then known, I was convinced that the method I then described as the "right-angle" continuous was the most satisfactory, other methods being discarded on account of their

complex character or the length of time and especial appliances required for their formation.

The "right angle" continuous suture is a modification of the Kürschener or the "continuous Lembert." It has been called by some surgeons a modified "Appolito." It excels not only in neatness of appearance, but also in accuracy of wound union. It is not only continuous, but is also a "buried" suture, reducing adhesive inflammation to a minimum. It can with some practice be applied easier than other sutures; it can be applied *more rapidly than other sutures*, with scarcely an exception—a point of great importance. One of the many trials is the following: Resection of human ileum. Lembert suture required fifteen minutes; the continuous "right angle" (two experiments), five and nine minutes. I have united a resected ileum in the living human subject in eight and two-thirds minutes. With this suture the greater the distention of the intestine the closer the edges of the wound are approximated. It can be interrupted at any point, if desired. It can be reinforced by another superimposed, if any point seems insecure, either by itself or an "interrupted Lembert."

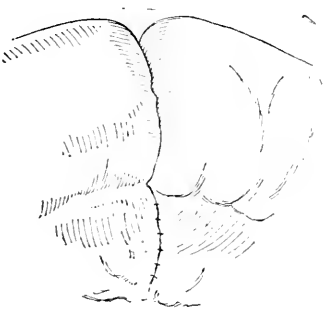
Its disadvantages are that its technique is not so readily learned as some—*e. g.*, the "Lembert." Again, it has been claimed that if there is much intestinal distention, constriction occurs with resulting obstruction to blood circulation and necrosis. I have found no record of such a result from a continuous suture. In my own experiments on living intestine, or in clinical observations, it has not occurred. It is an advantage rather; since the constricting circle is, during distention, more deeply buried (Fig. 1), thus approximating more extensively the inverted serous surfaces, through whose union mainly fecal extravasation is averted. With the Lembert the reverse is true. The sutures separate as the intestine distends and its circumference increases. The inverted edges become narrower by this stretching, and are in danger of everting and prolapsing outward between the sutures. Fecal extravasation is then possible.

In regard to septic infection and suppuration along the track

of the suture while being cast off into the lumen of the intestine, I know of no case where this has occurred. The experiments on animals show that the sutures may be partly exfoliated and hang free in the lumen of the intestine without causing septic inoculation of the wound, which has united long before the suture is thus freed, which requires from two to three weeks.

After an extensive review of the literature of the subject; careful and extended experimentation with living animals; practical tests and experiments with various sutures in the dead human intestine, and from personal observation during years of hospital service, I concluded that the most satisfactory suture

FIG. 1.



in most cases was the "right-angle" continuous, reinforced by a similar one superimposed, or by an "interrupted Lembert," if isolated points only require to be secured. If the suture is properly made its reinforcing will be, as a rule, unnecessary. The reasons for this conclusion are:

1. The suture does not involve the mucous membrane.
2. The intestine is closed by a suture which acts so that the greater the tension to which it is subjected, the closer it is drawn.
3. It can be inserted very rapidly and easily.
4. The closure of the intestine is impervious and efficient.[1]
5. Its technique is simple.

[1] In hydrostatic tests during experimental work the intestine ruptured at other points, usually along its mesenteric border, before the suture tore out enough to permit leaking,

In proof of the efficiency of this suture I desire to report a few results, recently collected, where it has been used by other surgeons than myself.[1] It is not a complete report of the clinical history of the method, for I have as yet made no effort to obtain such. I readily obtained records of twelve cases (including one case of rupture of the bladder) which include four resections—two cæcum, one ileum, one not stated; four wounds—tears, ruptures, or stabs (one case nine wounds of small intestine); two, fecal fistulæ; one, stomach anastomosis. Of these patients 75 per cent. recovered. In the fatal cases the wound was found closed or united in all except one, where the cause of death was pulmonary embolism. Here there had been distention of the intestine so extreme that several of the reinforcing layers of Lembert sutures had been torn out. The "right-angle" suture had also torn through at one point.

These are not selected cases, but are reported as they were collected. Some of the patients (exclusive of the fatal cases) were desperately ill.

The length of time required to close the intestine is interesting. For the tears and wounds (*i. e.*, longitudinal sutures) the average was six and one-half minutes. One wound, two inches long, was closed in two minutes. One, two inches long (operation, fecal fistula), required fifteen minutes, the maximum.

The resection wounds averaged ten minutes without the reinforcing suture. In one case the second continuous suture was placed in four minutes.

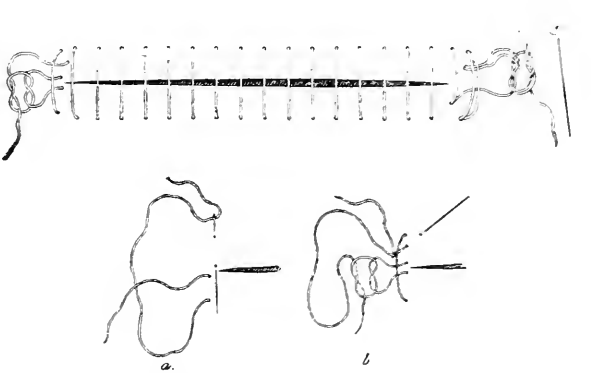
I, therefore, think it is fair to assume that the above data demonstrate that one can expect to close with this suture an ordinary intestinal wound or tear in six or seven minutes, or unite a resected gut in ten minutes; that when so united it will hold, if not better, at least as well as the best methods we now have at our command.

The perfected "right angle" continuous suture is shown in Plate. Its technique is as follows: For uniting longitudinal

[1] These results are from the records of Drs. H. L. Burrell, F. S. Watson, and J. C. Monro, through whose courtesy I am able to report them.

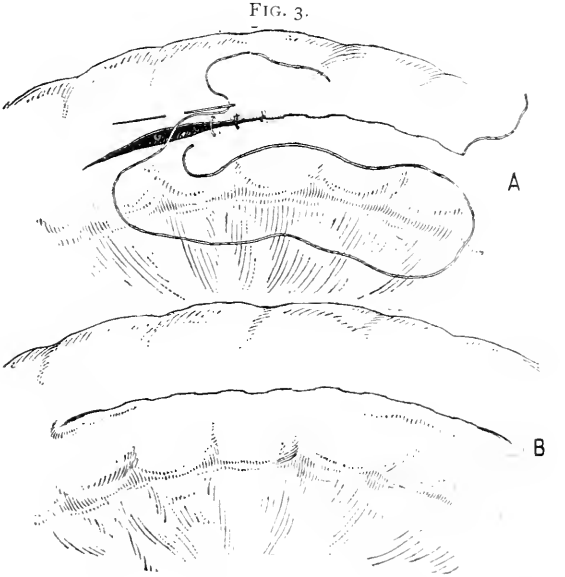
wounds it is inserted as shown in Figs. 2 and 3. The most satisfactory results are obtained in the human intestine by plac-

FIG. 2.



Diagrammatic. Actual size, as in human ileum. Peritoneal surface. *a–b*. Plan of suture at commencement of insertion.

FIG. 3.

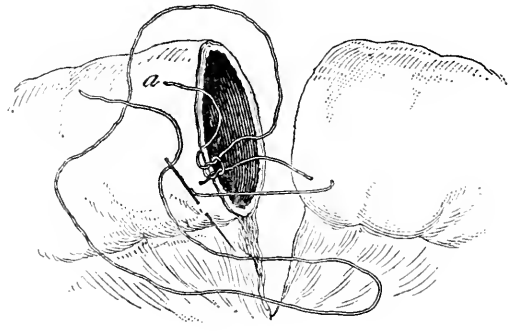


Ileum. Peritoneal surface. A. Suture in various stages of its formation. Note the direction of the needle inserted parallel to the wound instead of at a right angle to it, as in the Lembert and many other sutures. B. The completed suture. No knot or suture visible.

ing the points of puncture one-eighth of an inch (3 mm.) apart, and by burying the suture to the same extent in a direction parallel to, and three-sixteenths of an inch (4.5 mm.) distant from, the wound edges. The needle traverses the tough fibrous submucous layer, and is not intended to involve the mucous membrane or penetrate the intestinal cavity. Each stitch of the suture should be drawn tight, so as to accurately appose the wound edges before the next is set.

A resected intestine is united by the same suture, but formed as follows: It is begun at one side of the mesenteric attachment by an inverted Lembert suture, which is tied, and the free end (Fig. 4, *a*) left pendant from the knot.[1] The resected edges

FIG. 4.

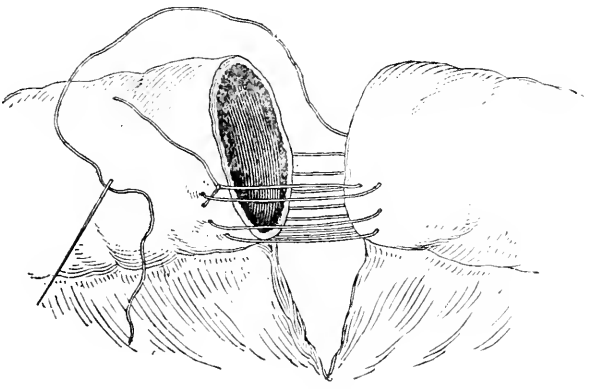


are now united by the "right-angle" suture, which is inserted in the same manner as a longitudinal wound, commencing at the point of union already made, crossing the mesenteric attachment (Fig. 5) and continuing along parallel to the resected edges of the gut until the free end (Fig. 4, *a*) at the point of commence-

[1] By commencing the suture at one side of the mesenteric attachment (as above-described Fig. 4, *a*) that portion of the wound is united first, and at a time when it is most accessible. The advantage of this is self-evident, since this is the most difficult point to unite securely, and at which fecal extravasation is most apt to occur; also, when completing the suture the operator can make the last few stitches and tie the final knot in full view at a point easily accessible, instead of at one so concealed and difficult of access as that portion of the wound about the mesenteric border, the site frequently selected for the completion of an intestinal suture.

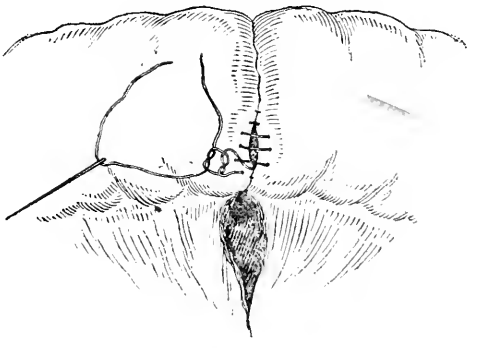
ment is reached. Care should be taken not to increase the distance of the suture from the resected edge, thus inverting a wider border. The suture also should not be drawn so tight as

FIG. 5.



to pucker or diminish the intestinal circumference. The union of the "terminal" end with the "initial" free end (*a*) by a square knot (Fig. 6) completes the suture, the free ends of

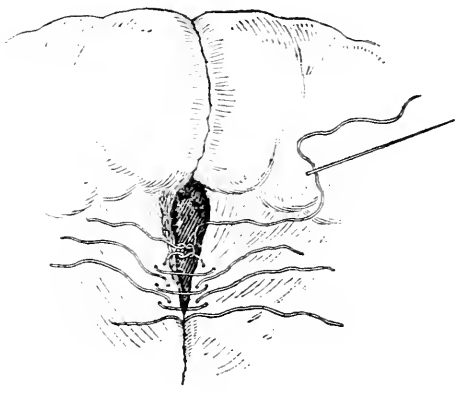
FIG. 6.



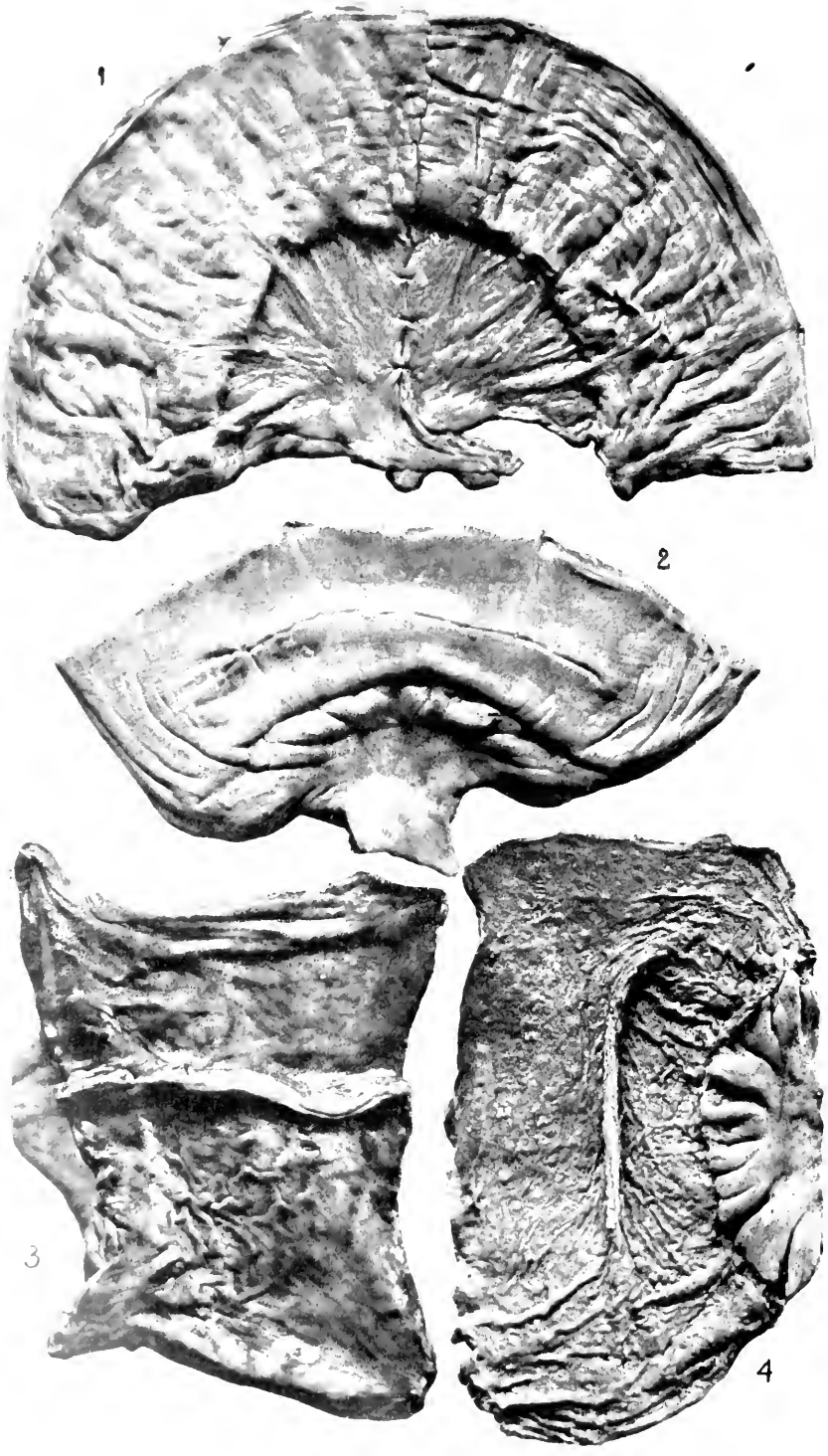
which are now cut close to the knot—if silk, one-tenth inch (2 mm.) long—which sinks out of sight between the approximated serous surface. The completed suture presents the appearance

shown in Plate. The mesentery is united by inverted Lembert sutures, interrupted, set on each peritoneal surface (Fig. 7). A very thin mesentery is best sutured by an ordinary interrupted suture. Continuous sutures, when of any length, have been found at autopsy to have relaxed and allowed the mesentery wound to separate. For the suture I use the finest white

FIG. 7.



silk, "machine twist" (J. D. Cutter, No. 000), sterilized by boiling, preserved in sublimated ($\frac{1}{10}$ per cent.) alcohol (95 per cent.). The best needle is a "self-threading" or "spring-eyed" round sewing needle, one and one-sixteenth inch long. By having this ground flat, like a "Hagerdorn," an instrument is obtained which combines all the advantages of the round needle usually used; and is far superior to it, on account of the ease with which it traverses the intestinal wall.


1
2
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DESCRIPTION OF PLATE.

THE "RIGHT-ANGLE" CONTINUOUS INTESTINAL SUTURE.

Human ileum. Natural size. The specimens from which this plate was prepared were subjected to considerable manipulation before and while being photographed. This explains the exposure of the suture at two points in Fig. 2.

FIG. 1.—Resection wound closed with "right-angle" suture. Wound of mesentery united with "inverted Lembert" (interrupted). The resection suture is terminated at a point one-fourth of an inch above the mesenteric border of the intestine.

FIG. 2.—Longitudinal wound, closed by same suture.

FIG. 3 shows Fig. 1 from inside. Intestine has been cut open at about one-fourth its circumference from its mesenteric attachment, thus showing the manner in which the resected wound edges are inverted and apposed; also the accuracy of the apposition at the site of the mesenteric insertion. The exposure of the suture at two points on the upper side of the wound is an apparent one only. The suture was not visible in the specimen from which the plate was taken.

FIG. 4 shows Fig. 2 from inside. The intestine is cut open along the mesenteric border and turned back, thus exposing the mucous surface. Shows the amount of inversion of the wound edges and the manner in which the edges are apposed.

METHOD OF SECURING URINE FROM EITHER KIDNEY BY THE URINE SEGREGATOR.

BY M. L. HARRIS, M.D.,
CHICAGO.

(BY INVITATION.)

As many of the members of this Association are familiar with the urine segregator from personal experience, and as the objects to be attained by the use of the instrument are well known to you all, my remarks will be confined to a consideration of the technique of its use.

The principle of the instrument is apparent at a glance, and its use quite simple; still, experience has taught us many little points that are quite essential to the successful use of the instrument.

The technique is neither difficult to understand nor to execute, and, from conversations with those who have used it, I have found that the few who have met with any trouble in the use of the instrument have done so by a failure to observe some little point which was already known, but which had not been given sufficient consideration.

One of the most important points which appears quite difficult for some to properly appreciate is the necessity of always clamping the forked connecting piece exactly at the right place on the sheath of the catheters.

It is the placing of this piece which determines the height of the septum or partition in the bladder, and, unless this piece is properly placed, the septum will be defective and an error in the findings may be the result.

As each instrument is distinctly and indelibly marked exactly where the forked piece is to be clamped, the slightest deviation from the proper place must certainly be looked upon as due to carelessness.

Before the introduction of the instrument it is essential that the

bladder be thoroughly cleansed by irrigating with warm sterilized water. This should never be neglected, no matter how certain one may feel as to the location of the pathological changes before the examination.

After irrigating the bladder it should be left moderately distended with water; about 150 c.cm. are usually sufficient. This not only facilitates the rotation or opening of the instrument, but, by keeping the walls of the bladder asunder, prevents the beaks from scraping from the bladder wall pathological products which may be washed out subsequently by the urine, and thus appear to come from the kidney. The escape of the water after the instrument is introduced also assures the patency of both catheters.

Before introducing the instrument the straight tips should be closed by being connected with the short piece of rubber tubing, and the curved tips by the long piece, so that the water in the bladder will not escape until the instrument is properly adjusted.

The lever inserted into the vagina in the female, or the rectum in the male, should be maintained strictly in the midline, and the inner end should not be permitted to slide past the catheters to one side or the other before they are opened. The lever should pass through the fork, and should be introduced until the perforation near the handle is opposite the perforations in the fork. The catheters should be rotated slowly and gently, so as not to injure the bladder nor to excite it to spasmodic contraction.

After the introduction of the lever and the rotation of the catheters the water is permitted to escape by removing the tube from the curved tips. When properly adjusted the diverging catheters should abut directly the internal meatus, for, if pushed too far in, the ends may project beyond the ureteral openings, and thus prevent the proper flow of urine. After the catheters are opened they should be gently drawn on until they are felt to impinge against the neck of the bladder.

The instrument should at all times be maintained strictly in the midline, and the outer ends of the catheters distinctly on a higher level than the inner. After the water has been permitted to escape, and the vials and bulb attached, we must wait patiently until the urine begins to flow. This usually takes place at once, but occasionally it seems to be temporarily suppressed, and I have been obliged to wait as much as thirty minutes after the instrument was adjusted for

the flow of urine to begin. While thus waiting, do not labor under the misapprehension that vigorous action of the bulb is going to hasten the flow, as it will do nothing but hurt the patient and injure the bladder. As fast as the kidneys secrete the urine it will flow, and no faster.

The tubes being filled with fluid and the vials on a lower level than the inner ends of the catheters, a siphonage is established which is usually sufficient to ensure the immediate escape of the urine as fast as it flows from the ureters. The bulb, therefore, is merely a safeguard, to prevent a stoppage of the catheters and to guard against the possibility (rarely present) of urine accumulating in the bladder, owing to a slight negative tension. The bulb need be used, therefore, only with the greatest gentleness. The flow of urine is always intermittent, never continuous, and the two sides may flow synchronously or asynchronously. When asynchronous the interval may vary from a few seconds to a few minutes. This possibility should always be borne in mind, and one must not too hastily conclude, because the flow does not at once begin on both sides, that one kidney is absent or that some mechanical obstruction exists. I have seen intervals of alternating activity of from ten to twelve minutes. The rate of flow may also vary much. I have collected 5 c.cm. in thirty minutes, and, again, in another case, as high as 10 c.cm. in two minutes—a flow thirty times as fast.

It should be remembered that the catheters and tubes leading to the vials remained filled with water after the water is allowed to escape from the bladder, hence the first that drips into the vials is this water, and it must be discarded until urine is seen to drip. When urine is seen to drip we begin to time the flow and to collect for examination.

In former articles—*Northwestern Lancet*, November 15, 1898; *Medical Record*, April 1, 1899—I have called attention to the method of estimating the "functional capacity" of each kidney, and to the great diagnostic and prognostic value of the information thus obtained.

In closing, I wish to mention that the instrument is as applicable to the male as it is to the female.

An anæsthetic is seldom necessary, but when advisable, owing to a sensitive, painful bladder or a highly nervous patient, one should always be used.

INTESTINAL ANASTOMOSIS: DEMONSTRATION OF A NEW FORCEPS.[1]

By ERNEST LAPLACE, M.D.,
PHILADELPHIA.

(By Invitation.)

The many shortcomings of the present mehanical means for facilitating intestinal anastomosis have resulted in a general tendency to abandon them in favor of the suture method, unaided by any artificial means. The necessity, however, for rapidity and accuracy in suturing while performing the various operations for anastomosis of the intestines, as well as the simplification of the procedure, has led us to devise a forceps which presents the following characteristics:

1. It consists of two rings, introduced into the intestines to be anastomosed, and acts as a support to the parts while suturing them.

2. The forceps, being separable into two halves, can be gently withdrawn from a small aperture still unsutured, and the anastomosis is completed by adding one or two sutures.

The method offers the following advantages: First, rapidity and accuracy of suturing without leaving any foreign substance within the gut; second, an absolute control of the field of operation by means of the assistance of the handles of the forceps; third, the facility with which the forceps is applied, preventing the escape of intestinal contents during the operation.

There are five sizes of the forceps, for intestines of various calibre, as well as for the more delicate work on the gall-bladder (cholecystenterostomy). (Fig. 4.)

The accompanying illustrations (Figs. 1 to 22) give a fair idea of the appearance of the instrument, as well as the various steps in the technic.

[1] From Annals of Surgery, March, 1899.

Description of the Instrument.

The forceps consists of two parts, which are really hæmostatic forceps, curved into a semicircle on each side (Fig. 1); only held together by means of a clasp,[1] they open as two rings (Fig. 2). They are opened within the intestine, and serve the same purpose as Senn's rings or any other ring that has been devised, bringing serous membrane to serous membrane. Accurate suturing is the operation of the present. Therefore, if these forceps are within the gut, and sutures are applied, as they would be with the help of Senn's rings, it follows that sutures are introduced all around, except where the forceps penetrate the parts that are sutured. The suturing being done, the forceps are released by loosening the clasp, and then withdrawing the forceps out of the small opening; first one-half, then the other, when the operation is finished by a stitch or two. This forceps will serve for the operation of end-to-end anastomosis, and also of lateral anastomosis.

Gastro enterostomy (Lateral Anastomosis). An incision is made in each part to be anastomosed about the length of the diameter of the rings to be used. In our illustration gastro-enterostomy is performed. An incision has been made into the stomach and one into the gut. Opening the forceps one blade has been introduced into the stomach, then the other blade is put into the intestine, and the two blades are then closed. This holds in close contact the serous membrane of the stomach and intestine, while sutures are applied all around, except, of course, at the small place where the instrument penetrates the stomach and the gut. Continuous sutures are used in the illustration, but any suture may be employed. The handles are made to raise the parts up, and afford support as well as a broad surface to work on. Having united the stomach and intestine as far as is desired, the forceps is easily loosened by removing the clasp.

The forceps constituting one-half of the ring is loosened and drawn out with a semicircular motion, then the other is removed in the same way. Finally, one or two more stitches are applied, to close the opening through which the forceps was removed. This completes the operation, which shows that the suture was more regular than could

[1] This has lately been modified into a cross-action clamp, bent at an angle. The pins on each half of the forceps fit into perforations near the end of the clamp.

possibly have been applied without a support, and the support did no harm to the intestine. The mechanical means only serve to make the manual execution better. The guidance of the ring forces us to preserve the proper direction in suturing.

END-TO END ANASTOMOSIS. Having resected the required amount of intestine, the two ends are first united by a fixation stitch at the four cardinal points. This assures the right relation of the mesentery in the two ends of the gut. The forceps are introduced between two of these stitches. The blades are opened apart, so that one penetrates one end and the other the other end. The serous surfaces are inverted, or pushed in. This may be facilitated by drawing a thread around the united ends between the two blades. The forceps is clamped. When the forceps is clamped serous membrane is in apposition to serous membrane. The sutures are then applied all around the clamped surfaces, to the point where the forceps penetrates the gut. The clamp is removed; one-half of the forceps is removed. The other half is then removed. The operation is completed by adding one or two stitches, to close the opening through which the forceps was removed. The calibre of the gut is preserved.

INVAGINATION. Should it be desired to make an entero-enterostomy with invagination of the ends of the gut, the accompanying forceps (Fig. 5) facilitates the invagination and obliterates the end of the gut. It consists of a long, slender, straight hæmostatic forceps. The end of the gut is clamped and pressed down within the calibre of the gut; the serous membrane on each side thus rises and is rapidly sutured under the control of the instrument. When the suturing is done the instrument is loosened and withdrawn; one more suture is applied at the point where the instrument penetrated. This makes a very good stump, and is very expeditious.[1]

[1] This method was presented to the American Medical Association, at Denver, Colorado, June 9, 1898. A full description of it appeared on the same date in the Philadelphia Medical Journal. A demonstration of the workings of the forceps was also made before the Philadelphia County Medical Society, November 25, 1898.

FIG. 1. FIG. 2. FIG. 3.

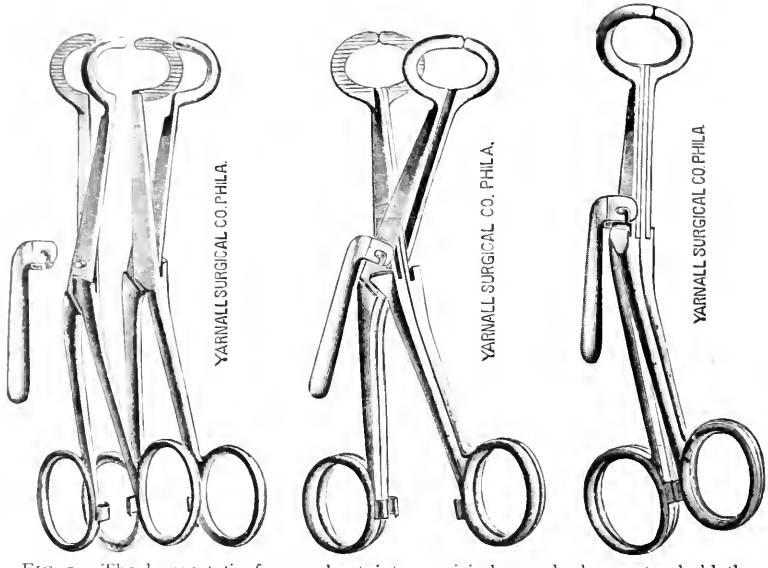

FIG. 1.—The hæmostatic forceps bent into semicircles and clamps to hold them together.

FIG. 2.—The forceps clamped together, and opened as two rings.

FIG. 3.—The forceps closed.

FIG. 4. FIG. 5.

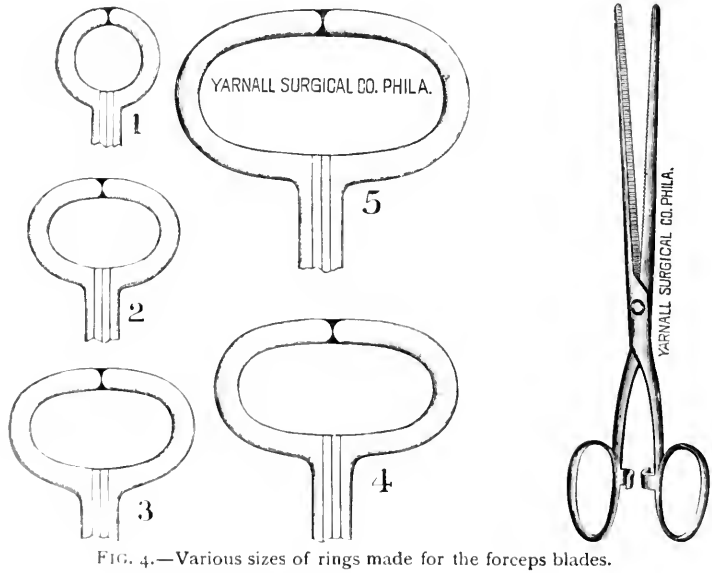

FIG. 4.—Various sizes of rings made for the forceps blades.

FIG. 5.—Invagination forceps.

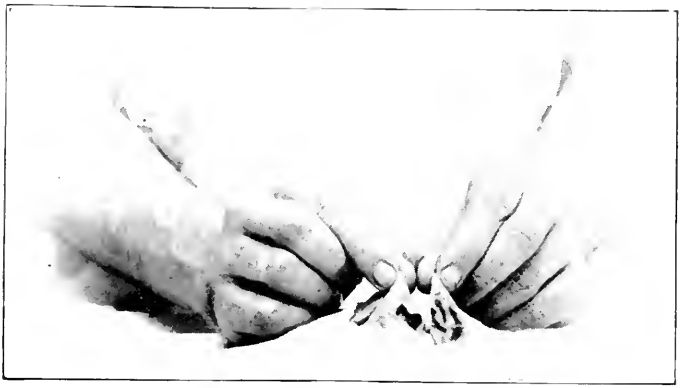

FIG. 6.—Gastro-enterostomy. Incision made in stomach and in intestine.

FIG. 7.—Gastro-enterostomy. One blade of forceps has been inserted into the stomach.

FIG. 8.—Gastro-enterostomy. Both blades are inserted in the parts to be approximated.

FIG. 9.—Gastro-enterostomy. The forceps are closed and clamped, approximating the serous membrane of stomach to intestine.

FIG. 10.—Gastro-enterostomy. Sutures have been applied circularly; the clamp is removed, loosening the forceps.

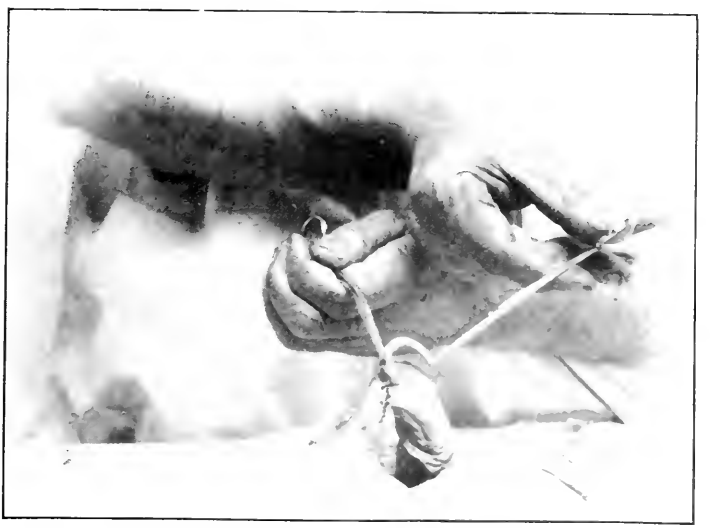

FIG. 11.—Gastro-enterostomy. One half of the forceps is unclamped; its grasp upon the tissues is loosened, and is removed by a semicircular motion through the small unsutured aperture.

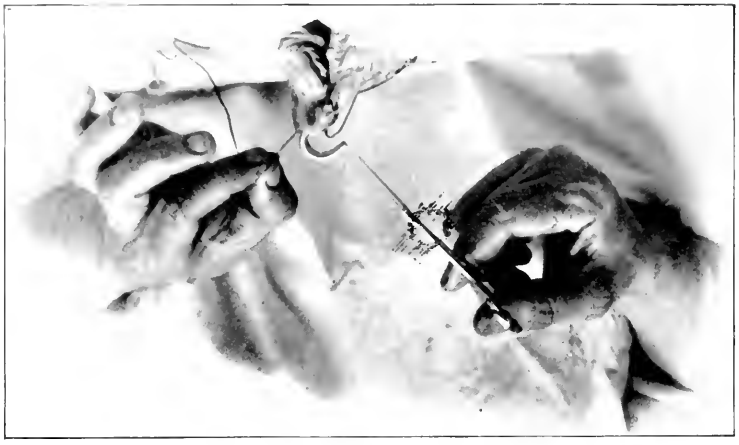

FIG. 12.—Gastro-enterostomy. The second half of the forceps is likewise removed.

FIG. 13.—Gastro-enterostomy. One or two more sutures close the opening through which the forceps were removed.

FIG. 14.—Gastro-enterostomy. The operation is completed.

FIG. 15.—End-to-end anastomosis. Four fixation sutures are applied at the cardinal points, uniting the ends to be approximated.

FIG. 16.—End-to-end anastomosis. The forceps is introduced between two sutures, and one blade is made to pass into each gut.

FIG. 17.—End-to-end anastomosis. The forceps is clamped, bringing serous membrane to serous membrane; sutures have been applied circularly.

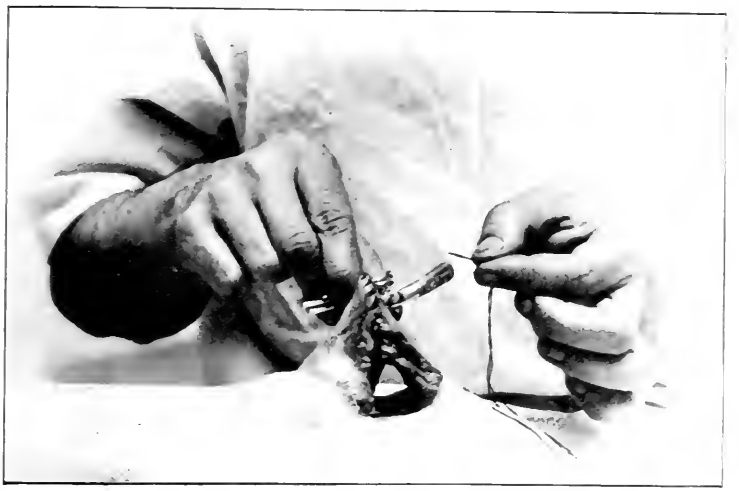

FIG. 18.—End-to-end anastomosis. The suturing is completed.

FIG. 19.—End-to-end anastomosis. One half of the forceps is being removed from small unsutured opening.

FIG. 20.—End-to-end anastomosis. Removal of second half of forceps.

FIG. 21.—End-to-end anastomosis. The anastomosis is completed.

FIG. 22.—Invagination. End of gut to be invaginated.

FIG. 23.—Invagination. End of gut is clamped with forceps.

FIG. 24.—Invagination. End of gut is pushed down and invaginated.

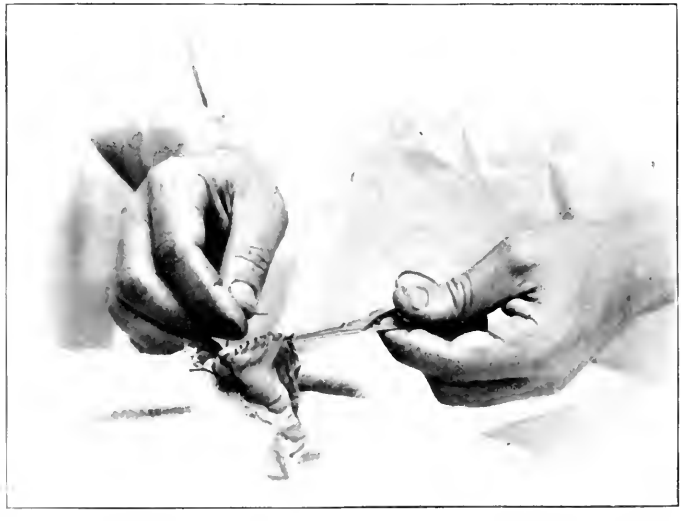

FIG. 25—Invagination. Sutures are applied superficially to the place where the forceps is.

FIG. 26.—Invagination. The forceps is loosened and withdrawn.

FIG. 27.—Invagination. One more suture completes the operation.

TUBERCULAR KNEE-DISEASE.

Clinic at Rush College.

By JOHN E. OWENS, M.D.,
CHICAGO.

A WIDOW, aged thirty-three years, suffering from tuberculosis of the right knee-joint.

Family History. Father fifty-five years old and healthy. Mother died during parturition; brother died at four years of age from measles.

Previous History. Patient has been in the enjoyment of health, with the exception of the disease in the knee-joint. She has two healthy children, aged six and four years respectively. One child, aged one year and four months, died of cholera infantum. There is no history of an injury having antedated the attack, and the patient is unable to assign any cause for the disease above referred to. The first symptoms began about four years ago.

Mode of Invasion. Slight pain in the right knee, worse at night after the day's exercise. The pain gradually increased in severity, and in a month swelling supervened. Soon flexion was added to the two symptoms just noted, and this became more marked as the case progressed. Eight months ago the patient fell, and the knee has been worse since that time. Her previous treatment consisted of eight injections of iodoform emulsion, and fixation by means of plaster-of-Paris.

Since admission to the hospital patient has been able to be out of bed in wheeled chair. She is fairly well-nourished; pulse 84; respiration 20; tongue clean; digestion fair; appetite good; moderate loss of weight.

May 17th. Pulse 84; temperature 99.2°. May 18th. Pulse 100; temperature 99°. May 30th. Pulse 100; temperature 99.6°.

Present Local Condition. Moderate tenderness; flexion a little less than right angle; subluxation; patella almost immobile. There is an exostosis just above the inner condyle on the front of the femur. There is no evidence of pulmonary tuberculosis. Excision of the joint was performed June 1st.

The whole joint, including patella, was removed through a convex incision beginning at a point well behind and above one condyle, extending downward and forward across the upper edge of the tubercle of the tibia, and terminating behind and above the opposite condyle.

Another semilunar incision, starting in the one already described, passed across the knee at the lower edge of the patella and terminated on the opposite side of the joint at a point corresponding with the commencement. The second incision was planned in order to remove redundant skin. The semilunar cartilages were almost entirely destroyed, as well as the cartilage covering the patella and the condyles. The articulating ends of the femur and tibia were divided in the usual manner. The mass of diseased structure, including the patella, the synovial sac, and redundant skin, was removed in one mass. The suprapatellar pouch of the synovial membrane was found to be obliterated. Softening of cancellous structure was a marked feature, so that several slices of bone were removed to dispose of this and to secure proper adaptation of the contiguous surfaces.

A small tuberculous cavity, with cheesy contents, was discovered in the posterior part of the internal condyle. This was disposed of with a curette. The exostosis was removed through the excision wound.

The whole open surface was well rubbed with iodoform-gauze; the bones placed in apposition; the capsule of the joint was tightly closed with buried catgut sutures, except at the most dependent part; the tendino-muscular quadriceps extensor was sutured to a short stump of the ligamentum patellæ and other contiguous soft structures; skin wound closed with catgut sutures, except about an inch of each extremity, into which, but not between the bones, were inserted tents of iodoform-gauze. After the application of voluminous dressings, plaster-of-Paris was applied to the whole leg, including the foot. After the plaster set the leg was suspended.

The case ran an aseptic course, and was discharged from the hospital the first week in July. At this date (July 19th) a barely perceptible motion may be observed during attempted flexion and extension.

FIG. 1.

FIG. 2.

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